

**Volume 2
Of
TENDER DOCUMENTS**

**Technical Specification
And
BILL OF QUANTITIES**

**FOR FIRE FIGHTING SYSTEMS
NCSCM**

**National Centre for Sustainable Coastal Management
Anna University Campus, Chennai**

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01. AUTOMATIC DETECTION, FIRE ALARM AND PA SYSTEM

A. SCOPE OF WORKS. CODES & GENERAL REQUIREMENTS

1.0 SCOPE:

- 1.1 This specification covers the supply, installation, testing and commissioning of Addressable Fire Alarm System and various components, which constitute the system. This system shall be microcomputer based utilizing distributed processing technique. The system shall generally include power supply, indicating devices, cable and accessories etc., complete.
- 1.2 The equipments shall be properly packed for transportation, supply and delivery of the equipments at site.

2.0 CODES AND STANDARDS

- 2.1 The design, manufacture, testing and commissioning of various components of the Automatic Alarm System shall comply with all currently applicable statutes, regulations, and safety codes in the locality where the equipment will be installed. Nothing in this specification shall be construed to relieve the tenderer of his responsibility.
- 2.2 Unless otherwise specified, the Fire Alarm System and the components shall conform to the latest applicable relevant IS codes. The relevant Indian Standards are.
- a) Code of Practice for Automatic Fire Alarm System - IS 2189.
 - b) National Building Code 1970 (Latest Edition)
 - c) Fire Officers Committee regulations.

3.0 LIST OF COMPONENTS:

- 3.1 The following are the list of various components, which generally constitutes the Fire Alarm System, but not limited to it. The specific requirement of various equipments shall be as per enclosed specification.
- a. Addressable Push Button type manual call points.
 - b. Addressable Electronic hooters.
 - c. Addressable response indicators.
 - d. Addressable type Smoke detectors
 - e. Addressable type Duct detectors
 - f. Cables and wiring.
 - g. Fire Alarm main panel.
 - h. Repeater Control Panel.

4.0 TESTS:

- 4.1 All routine tests as per relevant standards shall be conducted before dispatch of the materials.
- 4.2 Copies of test certificates of tests conducted shall be furnished and approval obtained before dispatch of the equipment.

5.0 CLEARANCE AND APPROVALS

- 5.1 All detectors and sensors shall be approved by any of the following bodies as applicable:
- a) Under writers' Laboratories (UL) - USA
 - b) Fire Officers Committee (FOC) - UK
 - c) Any other internationally recognized body acceptable to EMPLOYER/ENGINEER. Approval certificates shall be furnished along with the bid.

- 5.2 Shall be solely responsible for obtaining the required approval and clearance for the different components and systems of the fire detection and alarm system from the following authorities as applicable.
- a) Dept. of Atomic Energy (DAE) Certification of safety from radioactivity.
 - b) Central Building Research Institute (CBRI), Roorkee
 - c) Central Mining Research Station (CMRS), Dhanbad.
 - d) Local Fire Authority

6.0 GENERAL REQUIREMENTS

- 6.1 The design construction and operational features of all types of detectors shall be in accordance with relevant standards. (The main fire alarm panel shall be located in the BMS room, Basement and the repeater panel at the guardhouse). The fire alarm system shall be generally as per the schematic diagram and the location of detectors, manual call points, etc., shall be generally as shown in the layout drawings.
- 6.2 Manual call points where the addressing capability is not an integral part, a separate Addressable interface unit shall be provided.

B. ADDRESSABLE TYPE, DETECTORS (MULTI SENSOR TYPE), PUSH BUTTON TYPE MANUAL CALL POINT, HOOTERS AND SPEAKERS.

1.0 MULTI SENSORS (ANALOGUE/ADDRESSABLE):

The multisensors must comply fully with the general requirements for intelligent point sensors. Multisensors shall comply with standard ISO 7240-15 for Enhanced Smoke Sensors. The multi sensors shall incorporate photo electronic optical smoke sensors, and high sensitivity thermal sensors, software interlocked to provide early warning from all types of smouldering and thermal fires. Multisensors shall be able to be operated as enhanced smoke sensors (ISO 7240 15), as smoke sensors only (EN 54-7), or as thermal sensors only (EN 54-5). The smoke element shall be of the light scattering type using a pulsed internal LED light source and a photocell sensor. The thermal element shall utilize high sensitivity, high speed thermistors optimized to measure small changes in temperature, and rate of change. The elements shall measure both absolute smoke and thermal levels, but also rate of smoke and thermal change. The smoke and thermal elements must report independently to the control panel, and must be software interlinked to enable intelligent high-level decision making.

The detector shall be capable of operating within the following environmental limits.

- a. Temperature operating range +10°C to +50°C
- b. Humidity operating range 0% to 95% RH (without condensation)
- c. Wind - not affected

The detectors shall comply with IS 2189 1999 specifications.

2.0 MANUAL CALL POINT

Each manual call point unit shall comprise of a push button of approved make with minimum 1 N.O. + 1 N.C. contacts. The push button shall not be shrouded and the same shall be projecting out from the surface of the enclosure. This whole assembly of push button shall again be enclosed in an external cast aluminium enclosure with all side covered except from the front side. The front side shall be sealed with breakable glass cover using neoprene or equivalent gasket. The glass cover shall be fixed in such a way that the actuating push button is kept depressed (with 'N.C.' contact closed and 'N.O.' contact opened) so long as the glass cover is intact. In case of fire, when glass cover is broken to give fire warning, the push button shall be released due to spring action hence giving remote fire alarm through the 'NO' contact which has now changed over.

- 2.1 The enclosure shall be completely dust, damp, weather and vermin proof with IP 65 protection.

- 2.2 The complete unit shall be suitable for wall/column mounting with necessary surface/recess mounting accessories as required.
- 2.3 The complete unit and the push button shall be painted 'Signal Red' (Shade No. 537 as per IS: 5). the internal surface shall be painted with 'White' Color.
- 2.4 Clear inscription reading (in English) and also in specified vernacular language "FIRE ALARM - IN CASE OF FIRE, BREAK GLASS" shall be provided for each manual call point unit, either on the enclosure or on a separate metal plate mounted behind the glass cover. In addition to this, a "RED" Lamp response indicator is provided which will light up on the actuation of the Manual call point to help to locate the Manual Call Point station that is operated.
- 2.5 Each manual call point unit shall be provided with the following accessories: -

An iron hammer of sufficient weight, which could be used to break the glass cover. The iron hammer shall be suspended on a hook fixed to the enclosure by means of a non- corrodible iron chain of sufficient length and ply to facilitate easy breaking of the glass cover.

The enclosure shall have provision for conduit entries/ cable glands at 2 places of 2 core 1.5 Sqmm PVC armoured cable.

An identification number (on a number plate) shall be provided for which each push button station will be same as the number given to the fire alarm indicating point on the remote fire alarm indicating panel. The details of numbering scheme will be intimated later.

3.0 ELECTRONIC HOOTERS (ADDRESSABLE TYPE):

These should be wall/ceiling mounted, electronic speakers with solid state circuitry with 2-tone system (viz. alert and evacuation working on 24V D.C). The sound should be distinct and against background noise with an audible range of at least 30 Mtrs in an interior of office etc. These speakers shall be suitable for fire alarm signal.

4.0 ADDRESSABLE TYPE REMOTE RESPONSE INDICATOR:

Whenever a detector is housed in an enclosed space or a number of detectors are housed in an enclosed space each detector or a group of detectors must have a single indicator outside. This will be of spring loaded filament lamp type with RED covered lens. This should be suitable for both surfaces and recess wall or ceiling mounting and of dust proof construction.

5.0 FIRE ALARM CONTROL PANELS SUITABLE FOR ADDRESSABLE SYSTEM

The panels should be of free standing floor/wall-mounting consoles as required and made out of 16 SWG CRCA sheet steel with dust, damp and vermin proof construction with neoprene gaskets. The panels shall be designed for IP-54 protection. The panels shall be painted in even baked enamel paint after suitable primer treatment. The panel shall be covered with a glass door with lock and key. The panel shall have a separate external junction box mounted on top of the panel for terminating the cables/conduits. This external junction box shall have suitable size of knockouts for cable/conduit connections. Suitable terminal blocks shall be provided for termination of external cables/wires. The panel shall essentially consist of:

- a) Fire Alarm System,
- b) Fault Alarm System and complete with all equipments necessary for the reception, control, monitoring, recording and relaying of signals originating from the trigger devices and for the activation of fire alarm sounders. The panel shall identify open circuit, short circuit, earth fault, removal or failure of detectors, components or connection failure as a fault and shall provide a fault warning and indication.

The panel shall be suitable for input supply of 240 Volts +/- 10% A.C. single phase, 50 Hz and 24 V D.C. standby battery supply, in the event of mains failure. The batteries shall be provided in the panel. The standby power shall be provided by means of batteries of sufficient ampere-hour capacity.

The change over from A.C. main supply to stand by power shall be fully automatic in either direction and shall be instantaneous, uninterrupted. The panel shall provide necessary stabilized D.C. voltage to the individual loop circuits as well as to the internal circuits.

The control panels shall also incorporate the following salient features: -

- 5.1 Fire alarm control panel shall function as a communications interface between Central processing unit and sensors and controlled devices. Control panel shall be intelligent each with its own microprocessor and memory.
- 5.1.1 Fire alarm control panel shall have main processor board necessary loop modules for detector loops, alarm output modules for external hooter/lamp, control output modules for various control functions through relay contacts and communication module for interacting with CPU.
- 5.1.2 Fire alarm control panel shall have facility to process the input signals and also have facility to control all the input data received from Addressable type detectors/Addressable interface unit located in various loops at different locations and from different field devices/switches.
- 5.1.3 Addressable Detectors/manual call point and required field devices in the various areas shall be connected to fire alarm panels by Class A or Class B wiring to the loop module. However, the number of such sensors per loop shall not be more than 125.
- 5.1.4 Fire alarm control panel shall have number of electronic filters to ignore false alarm and increase sensitivity to real fires for sensors. The sensitivity of each Addressable detector should be automatically raised if detectors are gradually polluted due to dust and other particles entering inside the detector. If detectors are more polluted, the control panel shall give warning that the detector needs service. The electronic filters shall recognize the unwanted alarm from detectors due to electrical spikes; pipe smokes etc., and raise the sensitivity limit accordingly.
- 5.1.5 The fire alarm control panel shall have optional printer facility to print out the alarm/trouble occurrences with suitable fire fighting measures.
- 5.2 Control panel shall also have the following features.
- 5.2.1 Logging an alarm, time.
- 5.2.2 Status checks of disable alarm addresses before they are restored.
- 5.2.3 Storing of alarms and the possibility of internal organization of alarms.
- 5.2.4 Fire control panel shall have facility to brief user guide menu to enable the operator for proper use of various menu functions.
- 5.2.5 User's menu structure for carrying various events shall be provided in the fire alarm control panel.
- 5.2.6 The fire alarm control panel display shall have facility of brief user guide menu to enable the operator for proper use of various menu functions.
- 5.2.7 The control panel shall have facility to set date and time and display the same.
- 5.2.8 Each Addressable detector, interface units can be disabled from panel for maintenance purpose and restore the same whenever required.
- 5.2.9 The status check of each detector, interface units for alarm, pre-warning, trouble, disabling shall be possible from control panel.
- 5.2.10 The control panel shall have memory storage for last 126 events and an alarm counter for number of alarms occurred after the control panel is installed.
- 5.2.11 The fire alarm control panel shall have mains on, disable, fault, pre-warning, more alarm (for two or more alarms) LED's and flashing fire signs on front panel.
- 5.2.12 Fire alarm control panel shall have the sounder silence, reset, more alarm, push buttons and also push buttons for user menu structures.
- 5.2.13 Power supply to the fire alarm control panel shall be 240V, 50 Hz, 1 Ph AC supply & 24V DC battery backup.

6.0 POWER SUPPLY UNIT:

A built in power supply unit shall be provided inside the control panel to feed voltage to the system as below:

The control panel along with its detection and alarm circuits shall get its operating power from the normal supply source at 240 Volts single phase. In case this supply source fails, it should automatically change over to its power supply unit consisting of battery, battery charger. The battery charger unit shall be automatic dual rate (trickle and boost) charging type.

- a) The capacity of the charger shall be such that the same can boost charge the battery (within 8 hours) while supplying the rated load of the fire alarm system. Facilities shall be provided to limit the voltage supplied to fire alarm equipment to their rated values during the time of boost charging. The charger shall normally supply the battery trickle charging current and the D.C. load of the fire alarm system. The battery shall normally float. In case the A.C. supply on the input side of the charger fails, the complete fire alarm system shall be supplied by the battery.
- b) Battery bank shall be 24V D.C. sealed maintenance free type conforming to latest IS specification and adequate capacity to supply fire alarm system power for a period of 24 hours in non-alarm state followed by 60 minutes operation of all soundless and other connected equipments from the instant of charger/charger A.C. failure.
- c) Switches, fuses, overload, devices, 0-30 V D.C. voltmeter, DC ammeter indicating lamps for mains and DC output and discharge test facility shall be provided in the power supply system.
- d) Visible and audible annunciation for trouble or failure in the power supply system like 'Charger failure', 'battery low voltage', etc. shall be provided.

Battery reverse indication shall also be incorporated.

7.0 LOCATION:

The location of the main fire alarm control panel shall be in an easily accessible position as well continuously monitored area (Basement floor in the BMS Room).

Adjacent to each panel, a specially prepared plan of the building with loop numbered list shall be mounted on a teakwood frame with glazed cover without any extra cost.

8.0 INSTRUCTION MANUAL AND DRAWINGS:

Manufacturer shall supply three sets of instruction manual detailing all the circuit diagrams, component, specifications, operational instructions, routine and periodical test methods and Frequencies.

9.0 PUBLIC ADDRESS SYSTEM:

The Public Address System is designed to serve the multipurpose of playing the music or to make general announcement or to transit the fire tone under fire condition. These different signals are transmitted through the same set of speakers hence different levels of priorities are allotted to different signals. The music is with the least priority and the fire tone is having next priority and the emergency announcements are having the highest priority level.

The System shall have pre-recorded message to be announced in all the groups/zones in case of fire. A signal from fire alarm panel shall initiate such announcements. This announcement shall have highest priority. The system shall have a chime module. The chime module shall generate two types of signals consisting of either a two-note chime or a single gong tone to capture attention before paging. A DIP switch shall be provided on the P.C. board for selection of the chime or gong. Two LED indicators for the chime and paging function for the adjustment of the output level, two-note frequency and chiming interval. The chime shall be activated by a remote microphone and or through the amplifier. Normally background music shall be played in the lobbies, stair cases, smoke free lobbies, Toilets, Driver's Rest Room and other common areas paging will receive a higher priority and the highest priority shall be accorded to emergency announcements initiated by the fire control panel. The speakers are distributed in the entire facility and are configured in different zones. The

announcement can be made in individual mode i.e. one zone at a time or to all the speakers simultaneously in ALL CALL mode. Public Addressing system comprising of

Wooden Cabinet / Metal Cabinet.
Ceiling ring speakers.
Public Addressing Amplifiers
Central Control Console

9.1 SPEAKERS:

Speakers are in wooden or metal enclosures. All the speakers are with its associated line matching transformers. The speakers are interconnected in the zone configurations. The types of speakers to be used in various areas are Common areas with false ceiling – 6 W flush mounting ceiling ring speakers Office areas – 6 W metallic/wooden cabinet speakers. These speakers shall have facilities for horizontal & vertical orientation and provision for easy installation.

9.2 PUBLIC ADDRESSING AMPLIFIERS:

These amplifiers are designed to accept the input sources i.e., Microphone/CD player/Fire tone generator. The output is having a 100 Volts line to take care of line drop. The Amplifiers are stacked inside the rack system. Tone control circuit is provided to alter the quality of the output as per the user's requirement.

9.2.1 RACK ASSEMBLY:

Rack assembly is to stack the public addressing amplifiers. This should be factory prewired and have different channels for AC mains cable and Audio signal Cables. The rack should provided be with wheels for easy maintenance. One lockable rear door should be provided. The rack assembly is operating on 230 VAC.

9.3 CONTROL CONSOLE:

The heart of the entire public addressing system is the Console. One microphone is given for announcements. The selection of Music or Announcements is done through the console. The system shall make provision for dual channel output i.e both music and audio announcement shall be made for the entire system in which either music or audio announcement shall be selected through a hardware or software switching facility. The announcements can be made through the control console zone wise such as Music, Fire tone or Announcements. The console is provided with keypads on a sloped surface. The switches are having respective LED's. The different modes of transmission in P.A System are as follows:

9.4 MUSIC:

The music is through the CD/ Players can be fed to the amplifiers. The music transmission is having the least priority. That is if FIRE condition occurs, then the Alert tone overrides the music in the speaker. If any announcement is made, then the music will be stopped till the time of announcement and continues after pressing key. To play music a separate switch MUSIC is given and by operating this switch, the music is transmitted to all departments/zones.

9.5 ANNOUNCEMENTS:

Announcements can be made through the microphone and by selecting the required zones. Announcements can be made in following modes:

1. Individual mode
2. All Call mode

In this mode announcement can be made to all the speakers simultaneously. This is useful when any common message to be passed to all. Also this is more convenient and fast to address the people during emergencies.

C. SPECIFICATIONS FOR CABLE & WIRING.

1.0 TYPE:

Wiring shall be with plain annealed copper conductor, PVC insulated, PVC sheathed construction. The conductors of cable shall be solid circular type.

2.0 RATING:

The wires shall be rated for 1100 Volts.

3.0 CORE IDENTIFICATION:

Cores shall be provided with the standard color scheme of PVC insulation conforming to relevant standards.

4.0 CIRCUIT RATINGS:

The current rating shall be based on the following conditions: -

- a) Maximum conductor temperature : 70 Degree C.
- b) Ambient Air Temperature : 45 Degree C.
- c) Ground Temperature : 30 Degree C.
- d) Depth of Lying : 750 mm

5.0 STORING, LAYING, JOINTING AND TERMINATIONS:

5.1 STORING:

On receipt of cables/wires at site, the cables shall be inspected and stored in a safe location.

5.2 LAYING:

Cables/Wires shall be laid as per the specifications given below: -

- a) Cables in Outdoor Trenches: Cables/Wires shall be laid in outdoor trenches wherever called for. The depth of the trenches shall not be less than 750 mm from the final ground level. The width of the trenches shall not be less than 300 mm. However, where more than one cable is laid an axial distance of not less than 150 mm shall be allowed between the cables. The trenches shall be cut square with vertical sidewalls and with uniform depth. Suitable shoring and propping may be done to avoid caving in of trench walls. The floor of the trench shall be rammed well. Wherever cables are bent, the minimum bending radius shall not be less than 12 times the diameter of the cable. After the cable/wire is laid and straightened, it shall be covered with 8cms thick layer of sand cushion. Over this, a course of cable/wire protection tiles or burnt brick shall be provided to cover the cables/wires by 50 mm on either side. Trenches shall be back filled with earth and consolidated and surplus earth to be disposed within the site as directed. Cables/Wires shall be laid in Hume pipes at all road crossings and in GI pipes at the wall entries. Approved cable markers made of CI indicating the voltage, number of cables/wires and the direction of run of the cables/wires shall be installed at regular intervals of 25 meters.
- b) CABLE LAID INDOORS:

Cable shall be laid in indoors wherever specified. Suitable clamps, hooks and saddles shall be used for securing the cables in position. Spacing between the cables shall not be less than 200 mm center to center. All concealed wiring shall be inside 25 mm HGMS conduit of reputed make.

6.0 JOINTING AND TERMINATIONS:

Cable jointing shall be done as per the recommendation of the cable manufacturer. Jointing shall be done by qualified cable jointers. Each termination shall be carried out using brass compression glands and cables sockets. Hydraulic crimping tool shall be used for making the end terminations. Cable gland shall be earthed by using suitable size G.I. wire/tape.

D. RECOMMENDED MAKES-FIER ALARM AND P.A. SYSTEM

- | | |
|---|--|
| 1. Manual Call Points | : EDWARD/NOTIFIER/ TYCO /KIDDE (Addressable Type)
HONEYWELL/KAC/THORN |
| 2. Electronic Hooters
(Addressable Type) | : PHILLIPS/EDWARDS/HONEYWELL |
| 3. Main & Local Control Panel
(Addressable type) | : EDWARD/NOTIFIER/HONEYWELL/TYCO
/KIDDE/APPOLO |
| 5. Selector Switches | : SIEMENS/L&T. |
| 6. Power Cables/Control Cables | : UNIVERSAL/NICCO/CCI. |
| 7. Push Button Station | : SIEMENS. |
| 8. Cable End Terminations | : M-SEAL/SIEMENS. |
| 9. Terminal Block | : ELMEC. |
| 10. Switch Fuse Unit and
Load Break Switch. | : ENGLISH ELECTRIC. |
| 12. HRC Fuses and Base | : ENGLISH ELECTRIC. |
| 13. Contactors/Relays | : SIEMENS/ABB. |
| 13. Smoke Detector | : TYCO/KIDDE/APOLLO/SYSTEM SENSOR |
| 14. Heat Detector | : TYCO/KIDDE/APOLLO/SYSTEM SENSOR |
| 15. Battery | : HITACHI/DRYSIL/JOHNSON |

Note: All bought-out items shall be of makes approved by the Local Statutory Authority. Equivalent makes to be got approved by the Engineer prior to placement of order.

02. AUTOMATIC FIRE SUPPRESSION SYSTEM

A. GENERAL REQUIREMENTS

1.0 SCOPE OF WORK & SPECIAL CONDITION

The scope of work includes complete design, supply, installation, erection, testing, and commissioning the Fire Hydrant system, Hose Reel system, First aid fire extinguishers with all necessary accessories, Sprinkler system, associated civil and electrical works of the fire protection system for the proposed project **NCSCM, CHENNAI**.

- 1.1 The fire protection system shall be designed as per requirements of Amendment No.3 to National Building Code of India NBC-2005 and specific requirement of **CHENNAI** State Fire Services.
- 1.2 It is not the intent to specify completely herein all details of design and construction of the equipment/system. However, the equipment shall conform in all respects to high standards of engineering, design and workmanship and be capable of performing in continuous operation.
- 1.3 The contractor shall furnish warranty for the entire fire protection system for a defect liability period of Twelve (12) months after final official hand over date of the installation. This period shall include maintenance, replacement of parts, regular periodic visits by qualified personnel of the contractor and attending to emergency calls at short notice.
- 1.4 The contractor shall quote separately for comprehensive Annual Maintenance Contract (including all material and labour) for full Three (3) years period after the defect liability period (DLP). The contractor shall bear full responsibility for all kinds of maintenance which include periodic maintenance as well as attending to all break-down and emergency calls at short notice whenever called. During this 3-year period the scope of annual maintenance includes repair and replacement of one or all parts as required. Besides, the replenishment of all consumables is also to be included in the scope of maintenance.

The contractor shall furnish a list of recommended spares along with quantity and unit price schedule to the Employer along with the bid. Employer reserves the right to order the required spares during the tenure or on completion of the Annual Maintenance Contract (AMC) at the prices quoted which should be valid for the entire maintenance period i.e., 3 years after DLP. Further the Employer reserves the right to place the order on the successful contractor. Prices quoted for AMC shall be considered for evaluation.

- 1.5 The complete fire protection system will be evaluated based on the Item rate contract for the enclosed Bill of Materials (BOM). The contractor should indicate unit rates for all the items. Contractor to note that the bill of material is indicative and for tender purpose/evaluation only. Payment shall be made as per the actual installed quantities after certification from the Engineer at site and not as per the BOM.
- 1.6 The Contractor shall furnish along with bid unit rates for all equipments/piping/valves/instrumentation/ fitting etc., included in the scope of work. These unit rates will be used for price adjustment. Bids without unit rate will not be considered for evaluation. Also any conditions on unit rates quoted in the offer are not acceptable.

2.0 SITE CONDITIONS

Temperature : Maximum 32.8 °C
Altitude : 29 feet

3.0 APPLICATION CODES AND STANDARDS

The work shall be carried out in accordance with the regulations of local bodies, if any and the following specifications and codes which may govern the requirements of the system.

IS 13039 - 1991	Code of practice for provision and maintenance of external fire hydrant.
IS 2190 - 1992	Code of practice for selection, installation and maintenance of portable First-aid Fire Extinguishers.
IS 2189 - 1988	Automatic Fire Detection And Alarm System
IS 908 - 1975	Fire Hydrant & Stand Post Type.
IS 3809 - 1979	Fire Resistance Test of Structures.
IS 1648 - 1961	Fire Safety of Buildings
IS 884 - 1985	First Aid Hose Reel For Fire Fighting.
IS 2171 - 1985	Portable Fire Extinguishers
IS 934 - 1989	First Aid Fire Extinguishers
IS 14609 - 1999	Dry Chemical powder for fighting ABC class fires – Specification.
IS 2871 - 1983	Specification for Branch Pipe, Universal, For Fire Fighting Purposes (First Revision).
IS5306	Code of practice for fire extinguishing installation and equipment on premises
IS 5132 - 1968	Hose reel tubing for the fire protection system.
IS 8090 - 1992	Specifications for coupling, branch pipe, nozzle used in hose reel tubing for fire fighting.
IS 906 - 1988	Specification For Branch Pipe With Revolving Head For Fire Fighting Purposes (Third Revision).
IS 901 - 1988	Specification For Couplings, Double Male And Double Female, Instantaneous Pattern For Fire Fighting (Third Revision).
IS 902 - 1992	Specifications for suction hose couplings for firefighting purposes.
IS 903 - 1993	Specification for Fire Hose Delivery Couplings, Branch Pipe, Nozzles and Nozzle Spanner (Third Revision).
IS 904 - 1983	Specifications for 2-way and three way suction collecting heads for firefighting purposes.
IS 905 - 1980	Specifications for delivery breechings, dividing and collection, instantaneous pattern, for firefighting purposes.
IS 906 - 1988	Specification for revolving branch pipe for fire fighting.
IS 907 - 1988	Specification for suction strainers, cylindrical type for firefighting purposes
IS 908 - 1975	Specification for fire hydrant stand post type.
IS 5714 - 1981	Specification For Hydrant, Stand Pipe For Fire Fighting (First Revision).
IS 909 - 1975	Specification for Underground Fire Hydrant, Sluice Valve Type (Second Revision).

IS 5290 1984	Specification For Landing Valves (Second Revision).
IS 3844 – 1989	Code of Practice for Installation and Maintenance Of Internal Fire Hydrants And Hose Reel On Premises (First Revision).
IS 9668 – 1990	Code of practice for provision and maintenance of water supplies and fire fighting.
IS 8423 –1977	Controllers for collating hose for fire fighting.

4.0 SHOP DRAWINGS

The drawings enclosed herewith are for the general guidance to the Contractor. The contractor shall upon the award of the work, furnish detailed and coordinated shop drawings necessary to carry out the work at site. These shall be submitted to the Engineer for the approval and the work shall be commenced only after the approval of drawing by the Engineer.

4.1 Drawing/Information Required from Successful contractor on award of work:

4.1.1 Pump GA and Cross sectional drawings.

4.1.2 Performance curve for the pump.

4.1.3 Necessary civil scope drawing for the system.

4.1.4 Bar chart showing engineering, manufacturing and dispatch of each equipment and erection services.

4.1.5 Drawing, literature and technical particulars of all bought out items.

4.1.6 Control logic diagram for the pump to start.

4.1.7 Schedule for valves and piping material.

5.0 INSPECTION AND APPROVAL

The contractor shall arrange all necessary inspection by Fire Brigade Authority. He shall also arrange for the tests and obtain and deliver to the Employer any approval required as per local bye laws / statutory requirements.

6.0 WELDING

The two ends of MS/GI pipes shall be cut to the perfect level with the machine. Both the ends of the pipe shall be chamfered in-ordered to achieve a V groove at the welding joint. The tack welding shall be done first at required points. After checking the perfect level and alignment continuous welding shall be done. Contractor to clear all the carbon formations on the pipe surface and make the joint shiny.

7.0 PAINTING OF ABOVE GROUND PIPES AND EQUIPMENTS

All piping, equipment, cabinets etc., furnished under this specification shall be properly painted with two coats of synthetic enamel paint over a coat of primer of approved color and make. There shall be sufficient time gap between the coats of paint and the primer to ensure that all the coats are dried properly. The contractor shall guarantee both the material and workman ship of first class quality corresponding to standard engineering practice. Any defective materials / workman ship shall be rejected, the contractor has to rectify / replace at his own cost. Guarantee certificate of the materials supplied shall be handed over to the company. Paint used for this work will be lead free quality.

8.0 WRAPPING AND COATING OF UNDERGROUND PIPES

All underground pipes and fittings shall be cleaned by rough cloth. First coat of bituminous paint shall be applied, over which 400 micron polyethylene sheet of suitable width is to be wrapped spirally by

overlapping at least by 15mm. Similarly second coat of bituminous paint shall be applied over which PVC wrapping followed by second layer of PVC sheet wrapping. It is important to ensure that PVC sheet wrapping joints, of both the layers, are staggered. All the joints shall be tested and approved by the engineer. The joints shall be painted with one coat of primer and two coats of approved enamel paint. The paint shall be same color for pipes and joints.

9.0 GUARANTEE:

The contractor shall guarantee the material and workmanship of the entire system is of first class quality and shall correspond to standard Engineering Practice. All the equipments/apparatus shall be guaranteed to yield the specified rating and design capacities, speeds. Any defective equipment/material/workmanship found short of the specified quality shall be rejected. Contractor shall make good the rejected items at his own cost. Guarantee certificate of equipments from suppliers/manufacturers shall be handed over to the Employer.

10.0 DEFECTS & LIABILITY

All the equipment/material and the system shall be guaranteed against defective material and workmanship for a period of 12 months from the date of commissioning and handing over the Employers along with all relevant documentation. The contractor shall repair/rectify or replace all the defective materials, components free of cost. In addition, normal maintenance shall be carried out periodically during the defects liability period including replacement of spares, as required.

11.0 INSTRUCTION MANUAL / COMPLETION DRAWING / TRAINING

The contractor shall furnish detailed instruction and operation manuals in quadruplicate. The contractor shall also furnish detailed completion drawings & Fire Safety Plans on a tracing paper to approved scale. The drawings shall be inclusive of control schematic, if any. The contractor shall train the Employer's personnel in the operation and maintenance of the system for one month.

B. FIRE HYDRANT SYSTEM

1.0 GENERAL

Without restricting to the generality, the fire hydrant system shall include the following:

- 1.1 Supply, installation, testing and commissioning of fire hydrant system with all inter related works as per standards.
- 1.2 Galvanized Iron Class "C" fire riser main within the building and as well outside the building.
- 1.3 Landing valves, hose reels, hose cabinets, fire brigade connections and connections to pumps and appliances.
- 1.4 Hydrant pump and its accessories.
- 1.5 All materials shall be of the best quality conforming to these specifications and subject to the approval of the Client.
- 1.6 Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.
- 1.7 Pipes and fittings shall be fixed to walls and ceilings by suitable clamps at intervals specified. Only approved types of anchor fasteners shall be used for RCC ceilings and walls.
- 1.8 Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat manner.

- 1.9 Valves and other appurtenances shall be as located that they are easily accessible for operation, repairs and maintenance.
- 1.10 Pipes for wet risers within the Building shall be GI tubes conforming to IS 1239 (heavy duty 'C' class) with flanged / welded joints.
- 1.11 Fittings for black steel pipes shall be malleable iron or approved type cast iron fittings with screwed / welded joints.
- 1.12 Joints for black steel pipes and fittings shall be metal-to-metal thread joints. A small amount of red lead may be used for lubrication and rust prevention. Joints shall be welded when approved by the Engineer.
- 1.13 Stand pipe 80mm dia for single headed yard hydrant & 100mm dia for double headed yard hydrant shall be of GI class 'C' as per IS 1239 PI-90 and FBA approved make.

2.0 PIPING

Under ground piping shall be of heavy duty GI Class 'C' conforming to IS – 1239. The piping shall be laid not less than one meter below the ground level, suitable masonry supports, and concrete anchor blocks of suitable design shall be provided at every change in direction of pipeline either horizontal or vertical and near every pipe joints, where soil conditions are unsatisfactory. All fittings shall be G I 'heavy' grade confirming to IS: 1239.

Above ground piping shall be heavy duty GI class 'C' tubes confirming to IS: 1239 Part – I. GI pipes shall be provided with welded joints only unless flanges are warranted. All fittings shall be heavy duty wrought iron or GI confirming to A 234 Gr. WPB sch.40 (IS: 1239 Part II). The flanges shall be drilled as per relevant Indian standards. The pipes above 150 mm dia shall be fabricated as per IS: 3589.

Flanges shall be faced and shall have jointing of rubber insertion of Neoprene Gasket. In case of Tyton pipes, the joint shall be made by using rubber gaskets as per manufacturers' specification. The joints shall be capable of withstanding a pressure of 20.0Kg/sqcm. All the above ground piping shall be supported by angle iron brackets on walls or suspended by hangers from ceiling or concrete pedestals at some places. Piping above ground shall be painted with two coats of approved enamel over a coat of primer after the installation and testing.

Pipes shall be carefully laid to the alignment, levels and gradients shown on the plan and sections and great care shall be taken to prevent any sand, earth or other matter from entering the pipes during laying.

Pipes shall be kept thoroughly clean during the course of laying. The ends of pipes shall be blocked with wooden plugs wedged home, at the end of each day's work to prevent dirt, rodents and insects etc., entering the pipe.

Flanged joints shall be used for connections to vessel equipment, flanged valves and also on suitable straight lengths of pipeline at strategic points to facilitate erection and subsequent maintenance work.

GI class 'B' pipes conforming to IS: 1239 with all necessary fittings as per the specifications mentioned above shall be used for Diesel engine exhaust pipe.

PIPE HANGERS, SUPPORTS, CLAMPS, BRACKETS ETC.,

All vertical/horizontal pipes shall be fixed by G.I/M.S. Clamps truly vertical.

All horizontal pipes running below roof slab shall be supported by Hi-tech supports made out of GI/MS adjustable rods threaded for a sufficient length to adjust the height of support along with clamping arrangement for holding the pipes of anchor fastening arrangement design. The design of the hanger shall conform to specifications as indicated in NFPA 13.

Structural clamps shall be fabricated from M.S. structural members e.g. rods, angles, channels, flats as per detailed drawing or as directed. Contractor shall provide all nuts, bolts, welding and paint the clamps with two coats of zinc chromate primer and two coats of epoxy paint. Wooden saddles shall be provided free of cost.

Slotted angle/channel supports on walls shall be provided wherever shown on drawings or as required. Angles/channels shall be fixed to brick walls and bolts embedded in cement concrete blocks and to RCC walls with suitable anchor fasteners. Holes required in RCC walls shall be neatly drilled by electric drills and no manual chiselling will be allowed. The spacing of supports horizontally shall not exceed 1.8 M.

Wherever M.S. clamps are required to be anchored directly to brick walls, concrete slabs, beams or columns, nothing extra shall be payable for clamping arrangement and for making good with cement concrete 1:2:4 as directed by the Engineer.

3.0 PIPE PROTECTION

All pipes above ground and in exposed locations shall be painted with one coat of red oxide primer and two or more coats of synthetic enamel paint of approved shade and color. The below ground pipes shall be coated protected using polymer based material.

The GI pipes laid in outdoor trenches/buried in earth shall be initially brushed to remove all foreign matter and two coats of primer shall be applied over the pipe. Primer is allowed to dry until the solvent evaporates and surface becomes tacky. The pypkote membrane consisting of seven layers of polyethylene polymerized bitumen and polyester mat with 4mm thick and 150 / 250mm wide shall then be wound in a spiral fashion and bonded completely to pipe by thermo fusion process. The overlap to be maintained at 15mm uniformly.

Pipes passing through masonry walls, foundation, beams shall be taken through embedded pipe sleeve of same material. The pipe sleeve size to be at least one and a half times (1.5) diameter of the crossing pipeline. The pipeline running below floor shall be given anticorrosive treatment same as for underground piping.

4.0 EXCAVATION

Excavation for pipelines shall be in open trenches to line and grade shown on the drawings or as required at site as per the instruction of the Engineer. Pipelines shall be buried to a minimum depth of 1000mm in all types of soil including soft rock, hard rock and disintegrated rock for laying fire water supply pipes.

The contractor shall support all trenches or adjoining structures with adequate wooden/steel supports wherever required.

On completion of testing, anti-corrosive treatment with wrapping and coating of the pipelines, trenches shall be refilled with selected earth available from the trench excavation including watering and consolidation in layers of 15cms layers and consolidated. The back fill soil shall be graded soil free from stones, pebbles, clay lumps and vegetation and any organic matter. The surplus earth after backfilling shall be deposited to an initial lead of 30 m or as directed by the Engineer.

5.0 PIPE SUPPORT BLOCKS

Contractor shall provide suitable Burnt Brick Masonry blocks of suitable dimensions at regular intervals of 3 meters to support the pipes and at every change in direction of the pipes running on terrace. Masonry blocks shall be constructed using Table Moulded Class I Bricks in CM 1:6 and plastered in CM 1:3, finished with a neat smooth coat of cement. Size of Blocks shall be 600mm x 600mm x 450mm. The construction of masonry blocks shall be measured as part of piping item.

6.0 BUTTERFLY VALVES

Butterfly valves shall be provided for pipes 50mm dia and above. The valves shall conform to IS 5312 and shall be CI construction, including nuts, bolts, washers, 3mm thick insertion rubber gasket complete as per the specifications. The valves shall be tested to a pressure of 16 Kg/sq.cm.

Butterfly Valves shall conform the following specification:

- Body : High duty cast iron to IS 210 Gr. FG 220 and BS 1452 Gr. 220.
- Seating : Molded insitu resilient lining of black nitrile rubber.
- Disk : Nylon coated S.G. Iron to IS 1865/SG 400/12 and BS 2729 Gr.420/12.
- Shaft : The shafts are made of stainless steel AISI 431. Only flanged end valves to be used with flanges drilled to BS 10 Table F. Valves shall be capable of being locked in open position. Hand wheel shall be with vertical gear unit for smooth opening and closing of the valve. Key rods with M.S. coated extended spindles to be provided wherever the valves are not approachable from the ground surface.

7.0 NON-RETURN VALVES

Non-return valve shall be of cast iron with gunmetal seat, non-return valves shall be of flanged type. Spring-loaded valves shall not be used. The valves shall be suitable for a test pressure of 21 Kgs/cm².

8.0 STRAINERS

Strainers shall be preferably of approved 'Y' type or pot type as specified in the tender schedule with GI or fabricated steel bodies. Strainers upto 50 mm shall be of gun metal type. Strainers shall have a removable bronze screen with 3 mm perforations and permanent magnet. Strainers shall be provided with flanges. They shall be designed so as to enable blowing out accumulated dirt and facilitate removal and replacement of all screen without disconnection from the main pipe. Strainers shall be provided with isolating valves so that they may be cleaned without draining the entire system.

9.0 RUBBER HOSE REEL

Contractor shall provide standard fire hose reels with 19mm dia high pressure Dunlop rubber hose of 30m length with gunmetal nozzles and control valve, shut off valve, all mounted on a circular hose reel drum of mild steel construction and cast-iron bracket. The hose reel along with 63mm dia landing valve and 2 nos 15M long 63mm dia hose pipes shall be installed in fire hose cabinet inside the building.

10.0 HYDRANT VALVE (LANDING VALVES) AND CP HOSE PIPE

The landing valve (internal) shall be gunmetal single headed type conforming to IS: 5290 complete with hand wheel, quick coupling, spring and blank cap.

Instantaneous pattern single headed hydrant valve, branch pipe and nozzle to be provided in the fire hose cabinet. The landing valves shall be fitted with instantaneous coupling conforming to IS: 901. The coupling shall be fitted with an internal plug secured by a chain. Landing valves shall be installed on hydrant risers at a height of 1.0 to 1.2 mtrs from the finished floor level. The landing valves shall be connected to the wet riser stand pipes by means of a suitable tee, the cost of which is deemed to be included in the unit rate for piping.

11.0 HOSE PIPES

Heavy duty hose pipe 63mm dia 2 nos 15M length in FHC inside the building and 2nos. of 15 mts length in external hose cabinet with 63mm dia. The hose shall be made as per IS: 636, Type

12.0 HOSE CABINET

Hose cabinet shall be glass (4 mm thick) fronted with double hinged door and lock. The cabinet shall be made of 16 SWG M.S sheet and spray painted to scarlet red color with word "FIRE". The hose cabinet shall be of suitable size to accommodate the following: -

- a) Landing valves (Single Headed).
- b) 63 mm hose pipe (2 lengths of 15 mtrs each).
- c) Branch pipe and nozzles (one set).
- d) Two keys of break glass recess for keys.

13.0 BRANCH PIPE AND NOZZLE

Branch pipes shall be of gun metal to fit into the instantaneous coupling. Nozzle shall be of spray or fog type of diameter of not less than 16 mm and not more than 25mm. Branch pipe and nozzle shall be of instantaneous pattern.

14.0 FIRE BRIGADE CONNECTION

Fire brigade inlet connection to the wet riser shall be comprised of four instantaneous pattern 63 mm dia. inlets with caps and chains complete with non-return valve housed in a 16 gauge MS cabinet with 4mm thick glass fronted door. The cabinet shall be 1000 mm x 300 mm x 400 mm size for recess mounting. Similarly, fire brigade inlet connection for tank filling comprised of two instantaneous pattern 63mm dia inlets with caps and chains with non- return valve housed in 750mm x 300 x 400mm cabinet.

15.0 AIR RELEASE VALVES

Provide 20mm screwed inlet GM single acting air release valve on all high points in the system or as shown in the drawings.

16.0 DRAIN VALVES

Provide 50mm dia GI pipe conforming to IS 1239 heavy class with 50mm Butterfly valve for draining any water in the system in low pockets.

17.0 TESTING

After laying and jointing, the piping shall be pressure tested by hydrostatic method. The piping shall be slowly filled with water in order to expel all the air. The piping shall then be allowed to stand full of water for 24 hours. Any leakages at flanges or elsewhere shall be rectified. The pressure shall then be applied by means of a test pump (either electric or hand operated). The test pressure shall not be less than 1.5 times the working pressure of the system.

Pressure gauges used for the test shall be accurate and shall preferably have been recalibrated before the test. The open ends of the piping shall be plugged during the test. Capacity of pumps shall be checked with respect to the contractor's piping and equipment layout. Tests shall be conducted to determine the delivery head, flow and BHP of pumps after installation. All the test results shall correspond to the performance curves. All the leaks and defects in joints revealed during the testing shall be rectified to the satisfaction of the Engineer.

The system shall also be tested for its desired performance and function by opening hydrant valves on each floor separately and four landing valves simultaneously. The flow of water at the top most hydrants shall be checked when three landing valves below are open. The cutting in and cutting out pressure setting of starting device shall also be checked for its correct operation.

Contractor to rectify all leakage, make adjustment and retest as required and directed to the satisfaction of the FBA authorities and the Employer.

The test results shall be recorded and countersigned by Engineer and the same shall be submitted in triplicate for approval to the Engineer.

C. FIRST AID FIRE EXTINGUISHERS

- 1.0 Work under this section shall consist of furnishing all labour material appliances and equipment necessary and required to install fire extinguishing hand appliances.
- 2.0 Without restricting to the generality of the foregoing, the work shall consist of the following.
 - 2.1 Fire Extinguishers shall conform to the following Indian Standard Specifications as revised and amended up to date.

Soda Acid Type	:	IS 934-1967
Foam Type	:	IS 933-1967
Dry Powder Type	:	IS 2171-1962
Fire Buckets	:	As per ISI
Carbon Di-oxide	:	IS 2878/1976
Water Base ABV	:	IS 940/1976
Mechanical Foam Type	:	IS 10204
 - 3.0 Fire Extinguishers shall be installed as per Indian Standard Code of practice for selection, installation and maintenance of portable first aid appliances IS 2190-1971.
 - 4.0 The appliances shall be installed in readily accessible locations with the appliances brackets fixed to wall by suitable anchor fasteners.
 - 5.0 Operating instruction shall be provided and mounted in a brushed stainless steel frame with a clear plastic cover adjacent to the control panel. The instructions shall include the following:
 - 5.1 Procedure to follow when fire is detected.
 - 5.2 How to reset and test the entire system after trouble or fire is detected.
 - 5.3 Scaled sketch of the building showing location, type and the zone to which all detectors and manual pull stations are connected.

D. PUMPS AND ACCESSORIES

1.0 GENERAL

Firewater to the complete fire protection system shall be catered through 5 no of Overhead Tanks of capacity **10000 Lts per riser** respectively

The pumps shall be exclusively used for firefighting purposes and shall be provided as per the requirements of the National Building Code-2005.

1 set of FIRE pumps which includes **1 electric pump and 1 diesel pump of capacity 2280LPM** each and **1 electric pump of 180 LPM** each of Electric Motor Driven Booster Pump centrifugal pumps for riser and sprinkler system (if any) capable of delivering adequate flow at desired head shall be provided. The pumping capacity at terrace shall be **450 (+450 if sprinkled) LPM at 40 m head per riser.**

1.1 GENERAL REQUIREMENT

The electrical pump shall be horizontal centrifugal Single stage; Single outlet pump designed for continuous operation and shall have a continuously dropping head characteristic without any zone of instability. The power capacity characteristic shall be non over loading type.

The head vs. capacity, input power vs. capacity characteristics, etc., shall match to ensure load sharing and trouble free operation throughout the range.

In case of accidental reverse flow through the pump, the driver shall be capable of bringing the pump to its rated speed in the normal direction from the point of maximum possible reverse speed.

The contractor under this specification shall assume full responsibility in the operation of the pump and the drive as one unit.

The capacity of pump shall be a minimum of 150 percent of rated capacity at a total head of not less than 65 percent of the total rated head. The total shut off head shall not exceed 120 percent of total rated head on the pump.

An automatic air release valve shall be provided to vent air from the pump discharge and also to admit to the pump to dissipate the vacuum there, upon stopping of the pump. This valve shall be located at the highest point in the discharge line between the pump and the discharge check valve.

Pump coupled with motor or engine on a common platform shall perform smoothly without any excessive noise or vibration.

1.2 PUMP CASING

The casing shall be of cast iron capable of withstanding to the maximum pressure developed by the pump at the pumping temperature.

1.3 IMPELLER

The impeller shall be of standard bronze and shall be dynamically balanced.

The impeller shall be secured to the shaft and shall be retained against circumferential movement by keying, pinning or lock rings.

All screwed fasteners shall tighten in the direction of normal rotation.

1.4 SHAFT

Shaft size shall be selected on the basis of maximum combined shear stress.

The shaft shall be of stainless steel AISI-410 (ASTM – A – 276 Type 410) (BS 970 410 S 21) ground and polished to final dimensions and shall be adequately sized to withstand all stresses from motor weight, hydraulic loads, vibrations and torques coming in during operation.

Pump Shaft-Motor Shaft Coupling All shafts shall be connected with adequately sized flexible couplings with spacer of suitable approved design. Necessary guards shall be provided for couplings.

1.5 BASE PLATE

A common base plate mounting both for the pump and drive shall be provided with anti vibration mounting pads. The base plate shall be of rigid construction, suitably ribbed and reinforced.

Base plate and pump supports shall be so constructed and the pumping unit so mounted as to minimize misalignment caused by mechanical forces such as normal piping strain, hydraulic piping thrust etc.,

The Fire protection system contractor shall give all necessary details, drawings, foundation bolts, necessary templates and other relevant details to the civil contractor for carrying out the structural foundation for installing all the pumps.

1.6 VIBRATION AND BALANCING

The rotating elements shall be so designed as to ensure least vibration during start and throughout the operation of the equipment. All rotating components shall be statically and dynamically balanced at workshop.

All the components of pumps of identical parameters supplied under these specifications shall be interchangeable.

1.7 INSTRUCTION MANUAL AND TOOLS/SPARES

A comprehensive instruction manual shall be provided by the contractor indicating detailed requirements for operation, dismantling and periodic operation and maintenance procedures.

Recommended tools / spares shall be provided and their unit rate breakup shall be provided by the contractor.

1.8 ELECTRIC MOTORS

The motor shall be rated not to draw starting current more than 6 times normal running current. Motor shall be capable of driving the pumps at 150% of its rated discharge and shall be designed for continuous full load duty. The motor shall be capable of handling the required starting torque of the pumps. Speed of motor shall be compatible with the speed of the pump.

The cooling fans shall be directly driven from motor shaft.

Motor situated out door or exposed to the weather shall be weather protected.

Motors shall be enclosed type and shall have dust tight construction with suitable means of breathing and drainage to prevent accumulation of water from condensation. Drain holes shall exclude bodies greater than 6mm diameter.

All components shall be of adequate mechanical strength and robustness and shall be constructed of metal unless otherwise approved.

All motors shall be dynamically balanced.

The enclosure shall be designed to provide an effective sealing between the primary and secondary air circuits.

Winding insulation shall be class B 415V AC motor and winding shall be vacuum impregnated with heat and moisture resistant varnish glass fiber insulated.

Two independent earthing points shall be provided in accordance with IS: 3043 on opposite sides of the motor for bolted connection.

The cable boxes and termination shall be designed to enable easy disconnection and replacement of cables.

2.0 DIESEL ENGINE

2.1 GENERAL

PUMP DRIVEN BY DIESEL ENGINE:

The diesel engine shall be of multi cylinder type with individual head assemblies, four-stroke cycle with mechanical (airless) injection, cold starting type. The engine shall be water-cooled and shall include radiator, water pump and connecting piping, strainer, isolating and pressure reducing valves, by-pass line complete in all respects.

Engine shall be direct injection type with low noise and exhaust omission levels.

The speed of the engine shall match the pump speed for direct drive.

The engine shall be designed with regard to ease of maintenance, repair, cleaning and inspection. This will also provide interchangeability of parts.

All parts susceptible to temperature changes shall have tolerance for expansion and contraction without resulting in leakage, misalignment of parts or injury to parts.

2.2 STARTING

The engine shall be capable of both automatic and manual start. Generally the engine shall start automatically but in case of the auto-start system failure the engine shall be capable of manual start. Engine shall be able to start without any preliminary heating of combustion chamber; cranking mechanism shall also be provided. All controls / mechanism which have to be operated in the starting process shall be within easy reach of the operator.

A high DC motor charged by battery shall initiate automatic start of diesel engine. The battery shall hold adequate retainable charge to provide the starting of the diesel engine. Starting power will be supplied from two sets of storage batteries. One set of battery is for automatic starting of the engine and the other provided for manual starting. A selector switch will be provided at automatic starting control panel to select any of the two sets of battery for manual / auto starting of the engine. The battery capacity shall be adequate for ten consecutive starts without recharging with a cold engine under full compression.

System should be designed in such a way that both batteries are connected and are individually able to provide automatic pump starting. The battery circuits should be arranged to alternately attempt starting on one circuit first, then the other battery could be charged by an alternator on the engine with the other one charged by an independent means. The battery banks shall be used for no other purpose than starting of the engine and shall be fully charged at all times with provision for trickle and boost charges. After start of the engine the charger shall be disconnected, the battery being fed from the engine dynamo. The two battery charger of air-cooled type shall be able to charge one battery bank at a time.

The D/E starting panel along with the battery chargers should be approved by FBA.

2.3 GOVERNING SYSTEM

The engine shall have a speed control device that will control the speed under all conditions of load; the governor shall be suitable for operation without external power supply.

The Governor shall offer following features:

An adjustable governor to regulate engine speed within a range of 10% between shut-off and maximum load conditions of the pumps. The governor shall be set to maintain rated pump speed at maximum pump load.

2.4 FUEL SYSTEM

The diesel engine is to run on high speed diesel, the capacity of the day oil tank provided shall be minimum 500 liters.

2.5 COOLING WATER SYSTEM

Direct cooling system shall be employed for the diesel engine. Water shall be tapped from the fire pump discharge. This water shall be led through duplex strainer, pressure breakdown orifice and then after passing through the engine, the outlet water shall be taken directly to the sump through an elevated funnel.

Recirculating thermo siphon system of cooling using a fan cooled radiator or indirect cooling system using heat exchange shall not be acceptable.

2.6 ACCESSORIES

The engine shall be self-starting type and shall be provided with 12 Volts heavy-duty batteries, dynamo, starter, cutout, starter, cutout battery leads complete in all respects. Two additional spare batteries shall be provided.

The system shall be provided with an automatic fully connected battery recharger of approved type and capacity required for the system.

The engine shall be provided with an oil bath air cleaner.

The system shall be provided with a control panel with push button starting arrangement and wired to operate the engine on a differential pressure gauge.

The entire system shall be mounted on a common structural base plate with anti-vibration mounting and flexible connections on the suction and delivery piping.

There shall be reasonable space at the big end, camshaft, water jackets, governor drives and main bearings.

Providing one fully mounted and supported day oil tank fabricated from 5mm thick MS sheet of capacity (size 1 Mtr x 1 Mtr x 0.7 Mtr) 500 ltrs with inlet, outlet with valves, gauge glass, manhole cover. The cost of MS frame work for staging to be included.

Provide one exhaust pipe of MS 3 mm thick with suitable muffler to discharge the engine gases to outside open air as per site conditions duly painted. Exhaust pipe to be insulated and GI sheet clad from engine outlet up to muffler and located outside the building. The exhaust pipe shall be adequately sized for minimum pressure drop as per relevant code/standard and shall be housed clearing man height.

Provide all accessories, fittings and fixtures necessary and required for a complete operating engine set.

PRIMING TANK: Adequate capacity HDPE Tank to be provided with suitable sizes of inlets, outlets, scour and drain pipes. Priming tank to be with level controller float, with access manhole at the top with lid.

Pressure switches/sensing devices to be mounted on its own independent discharge header for all the three pumps to achieve automatic operation.

Air vessel tank made out of 4mm MS Sheet 300 mm dia x 1000 mm long with dished ends in 5 mm thick sheet with provision necessary for inlet, outlet, and safety valve duly painted inside with two coats of approved anti-corrosive synthetic paint.

The flywheel shall have graduated marking around the periphery to facilitate checking of valve and fuel timings.

2.7 INSTRUMENTATION

The diesel engine shall be provided with adequate instrumentation. The gauges etc., as required are provided in the Engine Panel.

Operating Condition for Pumps

Operating Pressure	Start	Stop
Jockey Pump both automatic	8.0 kg/sq.cm	9.0 kg/sq.cm.
Main Pump	9.0 kg/sq.cm	Manual

E. SPRINKLER SYSTEM**1.0 SCOPE OF WORK**

Sprinklers shall be provided at car parking area ceiling level as shown in the drawings. The class of hazard considered is ordinary hazard as per Local Statutory authority. As an optional item the sprinklers may be provided in other areas. The rated temperature of quartzoid bulb shall be 68°C to 79°C. Sprinkler heads shall be provided at approximate spacing to cover 6.96 to 12 Sq.m per sprinkler. The spacing shall however conform to the detailed drawing, in co-ordination with electrical and other allied services at the ceiling level.

A water motor gong and an inspection test connection shall be provided on the down streamside of the system.

2.0 SPRINKLER HEADS

Sprinkler heads shall be of Quartzoid bulb type with Standard bulb, valve assembly, yoke and the deflector. The sprinkler shall be of approved make and type.

2.1 TYPES**2.1.1 PENDENT PATTERN**

These sprinklers shall be designed to produce a hemi spherical type of discharge below the plane of the deflector with little or no water being discharged upwards to wet the ceiling.

2.1.2 SPRAY PATTERNS

The spray type sprinklers shall produce a hemispherical discharge below the plane of the deflector.

2.1.3 CEILING (FLUSH) PATTERNS: (CONCEALED TYPE)

These shall be designed for use with concealed pipe work. These shall be installed pendant with the cover plate flush to the ceiling with pushover rosette ceiling tile adjustable escutcheon screw adjustment concealed solder type sprinkler cover plate of proper temperature rating etc., as per manufacturer's specification.

2.2 CONSTRUCTION**2.2.1 BULB**

Bulb shall be made of corrosion free material strong enough to withstand any water pressure likely to occur in the system. The bulb shall shatter when the temperature of the surrounding air reaches a pre-determined level. Bulb used should be slimmer than the normal sprinkler bulb which is of fast response type.

2.2.2 VALVE ASSEMBLY

Water passage of the sprinkler shall be closed by a valve assembly of flexible construction. The valve assembly shall be held in position by the Quartzoid bulb. The assembly shall be stable and shall withstand pressure surges or external vibration with displacement.

2.2.3 YOKE

The yoke shall be made of high quality gunmetal. The arms of yoke shall be so designed as to avoid interference with discharge of water from the deflector. The sprinkler body shall be coated with an approved anti-corrosive treatment if the same is to be used in corrosive conditions.

2.2.4 DEFLECTOR

The deflector shall be suitable for either upright or pendent erection. The deflector shall be designed to give an even distribution of water over the area protected by each sprinkler.

2.2.5 COLOUR CODE

The following color code shall be adopted for classification of sprinklers according to nominal temperature ratings: -

Sl. No.	Sprinkler Temperature Rating (°C)	Colour of Bulb
1	57	Orange
2	68	Red
3	79	Yellow
4	93	Green

2.2.6 SIZE OF SPRINKLER ORIFICES

The following sizes of sprinklers shall be selected for various classes of hazards:

Ordinary hazard : 15mm nominal bore

2.2.7 STOCK OF REPLACEMENT SPRINKLERS

The following spare sprinklers shall be supplied along with the system:

Ordinary hazard : 24 Sprinklers

2.2.8 TEMPERATURE RATINGS

For normal conditions and temperature climates, rating of 79 °C shall be used. However, the temperature rating shall be as close as possible to, but not less than 30 °C above the highest anticipated temperature conditions.

2.3 PIPE WORK:

2.3.1 GENERAL

Pipes for the sprinkler system shall be GI pipes conforming to IS 1239 (heavy class) fittings for GI pipes shall be of approved make with flanged fittings. For jointing of pipes, butterfly valves check valves etc., refer to the specification given for Fire Hydrant System

2.3.2 PIPES ABOVE GROUND

The above ground sprinkler system pipes shall be heavy duty GI Class 'C' conforming to IS 1239. The fittings used such as bends, Tees, Reducers etc., shall conform to ASTM A 234 Gr. WPB forged.

2.3.3 UNDERGROUND PIPES:

Underground pipes shall be heavy-duty GI class 'C' pipes conforming to IS 1239, with anticorrosive treatment. The fittings used such as bends, Tees, Reducers etc., shall conform to ASTM A 234 Gr. WPB forged.

2.3.4 **WELDED PIPES**

The pipes of all diameters shall be jointed together by welding.

Special fittings of GI Forged and tapped to a special taper so as to make a metal to metal joint with the piping.

2.4 **INSTALLATION CONTROL VALVE**

Installation control valves shall comprise of the following: -

One main stop valve of full way pattern with gunmetal pointer to indicate whether open/shut.

One automatic alarm valve, fitted with handle and cover.

One hydraulic alarm motor and gong for sounding continuous alarm upon outbreak of fire.

One combined waste and testing valve including 5 meters of tubing and fittings.

Alarm stop valve.

Strainer.

Drain plug.

Padlock and Strap.

Wall box for housing all of above.

2.5 **PRESSURE GAUGE**

Bourdon type pressure gauges conforming to IS/BS specifications shall be provided at the following locations.

- a) Just above alarm valve.
- b) Just below alarm valve, on the installation stop valve.

2.6 **INSTALLATION OF PIPE (ABOVE GROUND PIPING) FOR SPRINKLER SYSTEM**

All above ground piping shall be installed on suitable pipe hangers/supports as required. The hangers shall be made of MS angles, channels, etc., and painted to the required finish (with one coat of zinc chromate primer and two coat of synthetic enamel paint). The spacing of piping supports shall be as follows:

20 mm to 32 mm dia. - 2.5 meters
40 mm to 65 mm dia. - 3.0 meters
65 mm and above - 3.6 meters

Piping shall be so installed that the system can be thoroughly drained. All the pipes shall be arranged to drain to the installation drain valve.

Piping shall be of screwed type up to and including 32 mm dia. Welding joints will be allowed for pipes of 40mm or larger diameters.

Sprinklers should have range pipes 25 mm dia of 150 mm length forming part of the fitting. Balance piping from Branch/ sub header will be measured part of piping works.

2.7 FUNCTIONAL TESTS

Upon the completion of the installation, the contractor shall conduct functional tests with simulated fire conditions in the space to be decided by the owners. The contractor shall supply all materials, labour and personnel required for the functional tests. Rate quoted in the BOQ shall be deemed to include cost of the above. (Refer of sub 18.0 for testing procedure)

F. 415 VOLTS FIRE PUMP PANEL

1.0 SCOPE OF WORK:

This specification is intended to cover the design, manufacture, assembly, testing at manufacturers' works, properly packed for transportation, supply and delivery, testing and commissioning complete in all respects with all components, fittings and accessories for efficient and trouble- free operation as specified hereinafter for the proposed project.

2.0 GENERAL INFORMATION:

The equipments shall be designed, manufactured and equipped with accessories in accordance with this specification and the applicable codes standards indicated below. Materials and components not specifically stated in this specification but which are necessary for satisfactory and trouble free operation and maintenance of the equipment shall be supplied.

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance and service life as specified here.

Switchboards shall be suitable for an ambient temperature of 45° C.

3.0 CODES AND STANDARDS:

The equipment covered by this specification shall unless otherwise stated be designed, constructed and tested in accordance with the requirements of the Indian Electricity Act and Rules and latest revision of the following standards.

IS 375	:	Arrangement of bus bars, main connection and auxiliary wiring
IS 722	:	AC Electricity Meters
IS 1248	:	Direct acting electrical indicating instruments.
IS 1822	:	Motor starters AC for voltages not exceeding
IS 8544	:	1000 V Direct-on-line AC starters
IS 2147	:	Degrees of protection provided by enclosures for low voltage switchgear and control gear
IS 2419 instruments	:	Dimensions of panel mounted electrical indicating and recording
IS 2705	:	Current Transformers
IS 2959	:	Contactors for voltages not exceeding 1000 V AC or 1200 V DC
IS 3231	:	Electrical relays for power system protection

IS 4064	:	Air-break switches, air-break disconnectors, air break switch disconnectors and MCC units for voltages not exceeding 1000 V AC or 1200 V DC
IS 3842	:	Application guide for electrical relays for AC System
IS4237	:	General requirements for switchgear and control gear for voltages not exceeding 1000 volts.
IS 4483	:	Preferred panel cutout dimensions for electrical relays
IS5124	:	Induction motor starters, AC (voltage not exceeding 1000 V) installation and maintenance code of practice.
IS 5987	:	Selection of switches (voltage not exceeding 1000 V)
IS 6875	:	Control switches for voltages upto and including 1000 V AC and 1200 DC
IS 8588	:	Code of practice for thermostatic bimetals Part-I general requirements and method of tests
IS 8623	:	Factory built assemblies of switchgear and control gear for voltages up to and including 1000 V AC and 1200 V DC
IS 8828	:	Miniature air break circuit breakers for voltages not exceeding 1000 Volts.

4.0 DESIGN REQUIREMENT

- 4.1 The switchboards shall be designed for 400/440 V, 3 phase 4 wire, 50 c/s supply.
- 4.2 Switchboards shall be suitable for direct online starting of all motors.
- 4.3 Control power supply of the Switchboards shall be 415 Volts, single phase, 50 Hz AC supply tapped for the respective module itself.
- 4.4 The switchboards manufacturers shall apply all de rating factors necessary to all components of the switchboards to comply with the conditions detailed in this specification.

5.0 CONSTRUCTIONAL FEATURES:

- 5.1 The switchboard shall be: -

Of the totally metal enclosed, indoor, floor mounted, free standing cubicle fixed type fuse switch units with compartmentalized design.

Be made up of the requisite vertical sections, which when coupled together shall form continuous dead front switchboards.

Provide dust and damp protection, the degree of protection being not less than IP 54 to IS 2147.

Be readily extensible on both sides by addition of vertical sections after removal of the end covers.

Switchboards shall have access to the feeders, bus bars, cable termination, cable alley etc. from front only.

- 5.2 Each vertical section shall comprise:

A front framed structure rolled/folded sheet steel channel section, of minimum 3 mm thickness, rigidly bolted together. This structure shall house the components contributing to the major weight of the equipment, such as circuit breaker cassettes, MCCB, MCB main horizontal bus bars, vertical risers and other front mounted accessories.

The structure shall be mounted on a rigid base frame of folded sheet steel of minimum 3mm thickness and at least 75mm height. The design shall ensure that the weight of the components is adequately supported without deformation or loss of alignment during transit or during operation.

Each compartment shall be provided with a hinged door interlocked with switch/breaker housed inside the compartments so that door cannot be opened unless the switch breaker is in 'OFF' position.

The design shall ensure generous availability of space for ease of installation and maintenance of cabling and adequate safety for working in one vertical section without coming into accidental contact with live parts in and adjacent section.

A cover plate at the top of the vertical section, provided with a ventilation hood where necessary. Any aperture for ventilation shall be covered with a perforated sheet having less than 1 mm diameter perforations to prevent entry of vermin.

Front and rear doors shall be fitted with dust tight neoprene gaskets with easy operating type fasteners designed to ensure proper compression of the gaskets. When covers are provided in place of doors, generous overlap shall be assured between sheet steel surfaces with closely spaced fasteners to preclude the entry of dust. The doors shall have concealed hinges. Removable screwed covers shall be provided on the rear of the cubicles.

- 5.3 The height of the panel should not be more than 2200 mm. The working height shall be limited to a maximum height of 1800 mm. The total depth of the panel should be adequate to cater for proper cabling space.
- 5.4 Covers and partitions shall be of minimum 16 Gauge sheet steel, whereas doors shall be minimum 14 gauge sheet steel. All sheet steel work forming the exterior of switchboards shall be smoothly finished, leveled and free from flaws.
- 5.5 All switches, push buttons etc. shall be operable from the front and shall be flush/semi flush mounted.
- 5.6 The apparatus and circuits shall be so arranged as to facilitate their operation and maintenance and at the same time to ensure the necessary degree of safety.
- 5.7 Apparatus forming part of the switchboards shall have the minimum clearances, as per relevant IS clearances shall be maintained during normal service conditions.

Creep age distances shall comply with those specified in relevant standards.

- 5.8 All insulating material shall be of DMC/FRP/SMC to withstand the effects of high humidity, high temperature, tropical ambient service conditions, etc.
- 5.9 Foundation bolts and nuts for each panel shall be supplied along with the respective switchboard
- 5.10 The lifting eyes for each shipping section and danger notice plates shall be provided for each switchboard.
- 5.11 Functional units such as circuit breakers and fuse switches shall be arranged in multi-tier formation.
- 5.12 Metallic/insulated barriers shall be provided within vertical sections and between adjacent sections to ensure prevention of accidental contact with:

Main bus bars and vertical risers during operation, inspection or maintenance of functional units and front mounted accessories.

Cable terminations of one functional unit, when working of those of adjacent unit/units.

- 5.13 All covers providing access to live power equipment/circuits shall be provided with tool operated fasteners to prevent unauthorized access.
- 5.14 Provision shall be made for permanently earthing the frames and other metal parts of the switchgear by the independent connections.

6.0 METAL TREATMENT AND FINISH

All steel work used in the construction of the switchboards should have undergone a rigorous metal treatment process.

All surfaces to be painted including interior and exterior of panels, and other metal parts shall be chemically treated to remove all rust, scale, grease and other adhering foreign matters using seven tank processes. All parts shall be coated with two coats of highly corrosion resistant primer followed by two coats of synthetic enamel paint (post office red) of approved colour and approved manufacturer. Matt finish of the painting is required.

The complete treatment, painting, drying with compressed air and storing operations shall be done in dry and dust free atmosphere.

Should finished paint chip off or crinkle during transit/handling/installation, the contractor shall arrange for repainting the equipment at site at his own cost.

7.0 BUS BARS

- 7.1 The bus bars shall be air insulated and made of high conductivity, high strength aluminum alloy complying with the requirements of grade E91E of IS.5082 and suitable for 415 Volts, 4 wire 50 Hz system.
- 7.2 The bus bars and connections shall be suitably supported / braced with non-hygroscopic DMC/FRP/SMC supports.
- 7.3 High tensile bolts and spring washers shall be provided at all bus bar joints.
- 7.4 The bus bars shall be liberally sized and shall have uniform cross section throughout, and shall be capable of carrying the rated current at 415 V continuously. The bus bars shall be designed to withstand a temperature rise of 45° C above the ambient. A current density of 1.3 Amps/Sq.mm shall not be exceeded for aluminum bus bars.
- 7.5 All bus connections, joints and taps shall be short and as straight as possible, and applied with contact grease in the mating surface.
- 7.6 The main horizontal bus bars shall be run through the entire length of the panel and shall be accessible for maintenance from the front as well as rear. Bus bar chamber shall have separately screwed covers. All bus bars, links, etc. shall be provided with insulating cover to prevent accidental contacts. The neutral bus bars shall have a continuous rating of at least 50% of the phase bus bars.
- 7.7 Bus bars shall be encased in colour coded heat shrunk PVC sleeves (snug fit type). An earth bus of size not less than 50 x 6 mm shall run through the length of switch boards at top or bottom as required.

8.0 MCCB - MOULDED CASE CIRCUIT BREAKER

The Moulded Case Circuit Breaker shall be incorporated in the switchboard wherever specified and shall be of the current limiting type. MCCB shall conform to IS 2516, IS 13947-1/ IEC 947-1 (part I & II / section 1) 1977 for general rules. It should be suitable for Horizontal and Vertical mounting and line load reversibility. MCCB shall be suitable either for Single Phase AC 230V On Three Phase 415V.

The MCCB shall be available in four pole versions for neutral isolation. It shall have tropicalization as standard feature.

The MCCB cover and case shall be made of high strength heat-resistant and flame-retardant thermosetting insulating material. The operating handle shall be quick make, quick break, and trip - free type. The operating handle shall have suitable 'ON', 'OFF', 'TRIPPED' indicators and in order to ensure suitability for isolation complying with IS: 13947-2/IEC947-2, the operating mechanism shall be designed such that the toggle or the handle can only be in 'OFF' position if the main contacts are actually separated.

8.1 ACCESSORIES

MCCB shall be designed to have following accessories and it shall be fittable at site.

- a) Under voltage trip
- b) Shunt trip
- c) Alarm switch
- d) Auxiliary switch

Remote operation using motor mechanism with facility of using the same in auto/manual mode

8.2 INTERLOCKING

MCCB shall be provided with following interlocking devices for interlocking the door of a switchboard.

Handle interlock to prevent unnecessary manipulations of the breaker.

Door interlock to prevent door being opened when breaker is in ON position

The interlocking device to open the door even if the breaker is in ON position

In addition to the above, any other features indicated in the Schedule of Quantities shall also be provided.

8.3 BREAKING CAPACITY

Short time with standing capacities different ratings of MCCB's shall be as follows:

Ratings [Amps]	Breaking capacity [KA]
01. Up to 200	20
02. 250 to 400	35
03. 630 to 800	50

8.4 INDICATING LAMPS

Filament type indicating lamps shall be provided wherever called for in the control schematic diagrams. The lamps assembly shall be complete with series resistor, bulbs, holders and lenses.

8.5 FUSES

All control and power fuses shall be link type HRC fuses and they shall be provided with visible indication to show that they have operated.

8.6 CONTACTORS

Contactor shall comply with IS 13947-1 for general rules and IS 13947 - 4.1 for Standards pertaining to Contactor and Motor Starter.

The Contactors shall be capable of withstanding breaking and making capacities per following:

AC3 category	AC4 category
Making Current 10 x Rated Current	12 x Rated Current
Breaking Current 08 x Rated Current	10 x Rated Current

Contactor shall be capable of withstanding an impulse voltage of 8KV and have an insulation voltage of 1000V.

Contactor shall be suitable for aluminum termination with a maximum permissible temperature rise of 650 C at the terminals with an ambient temperature of 500 C.

The coils shall have three terminals and the insulation should be of class H type.

The auxiliary contact block shall have a switching capacity of 220V, 2A.

Contactor shall have one auxiliary in built and it should be possible to have additional NO / NC contacts in steps of two.

Miniature Circuit Breakers [MCB]:

MCB shall be in 1,2,3,4, pole versions. MCB casing shall be made of self-extinguishing, tropicalised material.

MCB shall comply with IS 8828-1996/IEC 898-1995. It shall be suitable for use in frequency range 40Hz to 60Hz and shall accommodate AC / DC supply according to requirements. It shall have a trip-free mechanism and toggle shall give a positive contact indication. It shall be suitable for mounting on 35mm DIN rail/surface mounting. It may be installed horizontally, vertically on the ceiling in any place without any change in electrical performance.

Line supply may be connected to either top or bottom terminals i.e. there should be no line-load restriction. Degree of protection when the MCB is flush mounted shall be IP40. MCB shall be supplied with clamping terminals fully open. Contact closing shall be independent of the speed of operator. The breaking capacity of the MCB shall be 9KA / 10KA. The MCB shall be capable of being used as Incomer Circuit Breaker and shall be suitable for use as isolator. In case of multiple MCBs in a single location (DB), it should be possible to remove any MCB without having to disturb other MCB in the vicinity.

8.7 CURRENT TRANSFORMERS (CT)

Current transformers shall comply with the requirements of IS 2705. They shall have ratios, outputs and accuracies as specified/required.

Current transformers wherever required and called for in the single line diagram and/or required shall be furnished.

The CTs shall be bar primary in epoxy-encapsulated type, rated for 415 V. The CTs shall be designed to withstand the thermal and mechanical stresses resulting from the maximum short circuit current.

The vendor shall ensure that the VA outputs of the CTs are adequate for the relays, meters and loads connecting them.

The CTs shall be provided with Class A/Class B insulation and proper polarity markings in a suitable manner.

8.8 POTENTIAL TRANSFORMER (PT)

All the Potential Transformers shall comply with the requirements of IS 3156 latest edition. All PT's shall be resin cast type and shall have Voltage ratios, output and accuracy class as specified in Data Sheet.

All PT's shall be single phase, dry type suitable for mounting inside the panel / cubicles. Clamps / brackets / supports required for the mounting shall be supplied along with PT.

Polarities and Terminal markings shall be clearly marked in all PT's.

Name plate indicating, voltage ratio, burden, accuracy class, type, Sl.No. make and model etc., shall be provided.

A common earth terminal for earthing of core, bolts, clamps (non current carrying metal parts) etc., shall be provided.

- | | |
|--------------------------------|--------------------------------------|
| a. Voltage ratio | : As detailed in drawing or in spec. |
| b. Type | : Resin cast |
| c. Burden | : Refer drawing or spec. |
| d. Class (Metering/Protection) | : Class-1 |

8.11 INSTRUMENTS & METERS

All instruments and meters shall be enclosed in dust proof, moisture resistant, black finished cases and shall be suitable for tropical use. They shall be calibrated to read directly the primary quantities. They shall be accurately adjusted and calibrated at works and shall have means of calibration, check and adjustment at site.

8.12 INDICATING INSTRUMENTS

Indicating instruments shall be flush mounted with anti-parallel white circular scales with black pointer and with black numbers and lettering. Knife edge pointers shall be preferred. Unless otherwise specified, the size of all instruments shall be 95mm x 95mm type.

The dials shall be free from warping, fading and discolouring. Spring controlled instruments shall be provided with front of board zero adjuster, capable of being safely handled while the instrument is in service. Instrument covers shall also have red marks on the dial corresponding to rated values of the associated primary equipment. Synchronizing instruments shall also meet the requirements of this clause.

The indicating instruments shall conform to IS1248 and shall have an accuracy class of 1.

The Ammeter and Wattmeter current coils shall withstand 200% of rated current continuously and 10 times the rated current for 0.5 seconds without loss of accuracy. Voltmeter and Wattmeter potential coils shall withstand 120% of rated voltage continuously and twice the rated voltage for 0.5 sec. without loss of accuracy.

8.12.1 Voltmeter

Voltmeter shall be suitable for operating directly on LT supply voltage 415V, 50Hz or with a PT as per the requirements.

All the Voltmeters used for rated operating Voltage of 415 / 110V as required at 50Hz AC. With a scale as required at site.

All Voltmeters are 95 x 95mm, suitable for mounting on the panel.

Type, Sl.No, Accuracy class and borders of the Voltmeter shall be indicated on the dial.

8.12.2 Ammeter

All the Ammeters shall be CT operated (5A) with a dial marked for line currents.

Type, Sl.No, Accuracy class, Operating Current, Burden etc., shall be indicated on the dial.

All Ammeters shall be of panel mounting type and shall be provided with zero setting screws.

8.12.3 Energy Meters

WATT HOUR AND VAR HOUR METERS shall be of the three-phase two element type suitable for measurement of unbalanced loads in three phase four wire circuits. They shall be of draw out type and suitable for flush mounting with back connecting terminals. The meter shall have glass covers removable from the front of the panel, without dismantling the meter from the panel. All permanent magnets shall be of the non-ageing type. The meter shall be fitted with a separate test block for testing of the reverse direction. They shall be provided with a separate test block for testing of the meters without disturbing the CT and PT secondary connections. They shall have cyclometer type of register. At least two sealing studs for sealing purposes shall be provided.

They Energy Meter shall be connected to the secondary of potential transformers and current transformers rated for 110/v $\sqrt{3}$ and 5 Amp respectively. These meters shall conform to IS: 13010 and have an accuracy of class 1.0 or better for KWH meter and 3.0 or better for KVARH meters. Meters shall be compensated for temperature errors and factory calibrated to directly read the primary quantities without the use of additional multiplying factor. Multiplying factor, if unavoidable shall be a multiple of 10. Number of digits provided shall be adequate to cover at least 1000hrs. of operations.

The current coil of the meters shall have a continuous overload capacity of 200% for both accuracy and thermal limits. Also the current coils shall withstand at least 10 times the rated current for 0.5 seconds without loss of accuracy.

8.12.4 Digital Load Monitor

Digital Load Monitor shall be capable of displaying the following parameters:

Line and Phase Voltages, Current, Active and Reactive Power, Power Factor, Frequency, Active and Reactive Energies, Maximum Demand etc

The Digital Monitor shall have four quadrant capabilities to measure both power and energy. It shall serve as data logger for all Electrical Parameter as and when scanned, displayed and stored. Built in memory shall have a storage capacity to store all Data up to a period of 30 days a more.

The Digital Monitor shall have RS 232/RS 485 Port for PC interface for remote data acquisition, telemetering capability, analysis and graph plotting.

It shall be capable of operating on Low Voltage networks with a input voltage 110V to 600V and on a CT either 1A or 5A.

Shall be mechanically robust, LED display, suitable for mounting on Electrical panels, capable of operating on 3Ph, 4Wire, balanced / unbalanced load, continuously on environmental condition such as temperature 0 to + 50°C, Relative humidity 100%

8.13 PUSH BUTTONS

Push buttons shall be of momentary contact type with rear terminal connection. These shall be suitably shrouded to prevent inadvertent operation. Integral inscription plates engraved with their functions shall be provided. All push buttons shall have two Normally Closed and two Normally Open contacts comprising rivets of pure silver. The contacts shall be able to make and carry 5 A and break up one amp inductive load at 250V DC.

8.14 CABLE TERMINATIONS:

- 8.14.1 Cable entries and terminals shall be provided in the switchboard to suit the number, type and size of the aluminum conductor power cables and copper conductor control cable specified in the detailed specifications.
- 8.14.2 Provision shall be made for top or bottom entry of cables as required. Generous size of cabling chambers shall be provided, with the position of cable gland and terminals such that cables can be easily and safely terminated. Removable undrilled plates shall be furnished for fitting the cable glands.
- 8.14.3 Sufficient space shall be provided to avoid sharp bending and for easy connection.
- 8.14.4 Multi way terminal blocks complete with screws, nuts, washers and marking strips shall be furnished for terminating the internal wiring and outgoing cables.
- 8.14.5 Power and control terminals shall be washer head screw type or stud type complete with crimping type connectors. Screw type terminals with screws directly impinging of conductors are not acceptable.
- 8.14.6 Each control terminal shall be capable for connection of 2 Nos. 2.5 mm standard copper wire at each ends.
- 8.14.7 Not more than two wires shall be connected to any terminal. If necessary, the number of terminals shall be jumpered together to provide wiring points.
- 8.14.8 Terminal block for current transformer secondary lead wires shall be provided with shorting and earthing facility.
- 8.14.9 Barriers or shrouds shall be provided to permit safe working at the terminals of one circuit without accidentally touching that of another live circuit.
- 8.14.10 Cable risers shall be adequately supported to withstand the effects of rated short circuit currents without damage and without causing secondary faults.

8.15 CONTROL WIRING

- 8.15.1 The wiring shall be completed in all respects so as to ensure proper functioning of control, protection and interlocking scheme.
- 8.15.2 All wiring shall be completed up to terminal blocks on the side of each unit module.
- 8.15.3 All control wiring shall be carried out with 1100/660 V grade single core PVC cable conforming to IS 694/IS 8130 having stranded copper conductors switchboard wires of minimum 2.5 Sqmm.
- 8.15.4 Wiring shall be neatly bunched, adequately supported and properly routed to allow for easy access and maintenance. Wires shall not be spliced or tapped between terminal point.
- 8.15.5 Wires shall be identified by numbered ferrules at each end. The ferrules shall be of the ring and of non-deteriorating material. They shall be firmly located on each wire so as to prevent free movement, and shall be interlocking type.
- 8.15.6 All control circuit fuses shall be mounted in front of the panel and shall be easily accessible.
- 8.15.7 All spare contacts of relays and switches shall be wired upto the terminal blocks.
- 8.15.7 Each of the DC Circuit shall be provided with two fuses one in the positive and the other in the negative for 2 wire DC ungrounded system of specified voltage.

8.16 GROUND BUS

An aluminum ground bus rated to carry maximum fault current shall be furnished along the entire length of each switchboard. Each stationary unit shall be connected directly to this ground bus by two separate and distinct connections in accordance with Indian Electricity Rules.

Grounding terminals on the ground bus shall be provided. Connectors shall be provided at either end of each PMCC for connection to station ground mat.

8.17 TERMINAL BLOCKS

Terminal blocks shall be 660 Volts grade of stud type. Insulating barriers shall be provided between adjacent terminals.

Suitable provision shall be made to terminate control/power connections in the respective module. Terminal blocks shall have a minimum current rating of 10 Amps and shall be shrouded. Provisions shall be made for label inscriptions. The wire terminations to the blocks shall be of screw type suitable for crimp type socket.

8.18 RELAYS

All Relays shall conform to the requirement of IS: 3231/IS: 8686 or other applicable approved standards. Relays shall be suitable for flush and Semi-flush mounting on front at with connections from the rear.

All Protective Relays shall be of draw out or plug in type/Modular cases with proper built in test facilities. Test blocks and switches shall be located immediately below each relay for testing. The auxiliary relays shall be self reset type.

All AC Relays shall be suitable for operation at 50Hz. AC Voltage operated relays shall be suitable for $(110 / \sqrt{3})$ Volts PT secondaries and Current operated relays for 5Amp. CT. secondaries as specified in this specification. Voltage operated relays shall have adequate thermal capacity for continuous operation.

Auxiliary Relays and Timers shall have pairs of contacts as required to complete the scheme. Contacts shall be silver faced with spring action.

All Protective Relays, Auxiliary Relays and Timers except the lockout relays and interlocking relays specified shall be provided with self reset type contacts. All, Trip and Timers shall be provided with externally hand reset positive action provided with inscription subject to /Consultant approval. Timers shall be of the electromagnetic or solid state type.

Wherever solid state relays are used the following requirement shall be met with:

All Relays shall be designed for operating under or ambient temperature 55°C and 100% relative humidity. Electronic type timers shall be as far as possible avoided.

All accessories required for correct operation of each relay shall be supported by the Contractor without any extra cost.

The solid-state relays shall be stable and suitably protected against transient / induced over voltages. The bidder shall state clearly in his list special requirements, if any, for DC input arrangement or cabling considered necessary for satisfactory operation of solid state relays quoted by him.

8.19 NAME PLATE

The panel as well as feeders compartments shall be provided with nameplate of anodized aluminum, with white engraving of black background. They shall be properly secured with self-tapping screws at the top of the cubicles. The panel/feeder descriptions shall be as indicated in the drawings/employers. The size of the nameplates shall be proportionate to the respective equipments.

Also individual panel number and danger plate shall be furnished at back of panel.

8.20 DRAWINGS AND MANUALS

The following drawings shall be supplied for each switchboard.

General arrangement drawing for each type of board showing constructional features and space required in the front of withdrawal of breaker, power and control cable entry points, location of various devices, terminal blocks, etc. GA drawings shall be submitted along with offer.

Foundation plan and anchor hold details including dead load and impact load.

Drawing and data sheet for each component.

Electrical wiring diagram

Terminal block arrangement drawing for outgoing feeders

Operation, maintenance and installation manuals, (one set to Employer).

Technical catalogues/leaflets of CTs, meters, lamps, etc. shall be submitted along with offer.

The approval of the drawing does not absolve the contractor from his obligation of ensuring proper and correctness of functioning/operation of the system.

8.21 TESTS

Routine and Type Test:

Type test certificates and results as per relevant Standards (Specifications) for all the equipment offered under the scope of this specification shall be furnished.

All routine tests on all major components shall be made as per relevant specification.

Inspection of Switch boards including inspection of wiring and electrical operational tests wherever necessary.

Dielectric Tests:

Insulation of the main circuit that is the insulation resistance of each pole to the earth and that between the poles shall be measured.

Insulation resistance to earth of all secondary wiring should be tested with 1000 V megger.

Insulation test shall be carried out both before and after high voltage test.

Each switchboard will be completely assembled, wired, adjusted and tested for operation under stipulated conditions to ensure correctness of wiring and proper functioning of all equipments.

All current carrying parts and wiring shall be subjected to a high potential test.

8.22 HIGH VOLTAGE TEST

A high voltage test with 2.5 K.V. for one minute shall be applied between the pole and earth. Test shall be carried out on each pole in turn with the remaining poles earthed. All units racked in position and the switches closed. Original test certificate shall be submitted along with panel.

Employer's reserves the right to get the routine tests witnessed by his representatives, if so desired by the Employer's. The contractor shall give at least 14 days advance notice for the above to the Employer's.

8.23 PACKING AND TRANSPORTATION

The switchboards shall be sent to site by road transport packed in wooden crates. The packing should be of high quality to avoid any damage to the equipments during transit. They shall be wrapped with polythene sheets before being placed in crates to prevent damage to the finish.

9.0 SPECIFICATION FOR STARTERS

- 1.0 Contactors shall be air breaker and the electromagnetic type rated for uninterrupted duty as defined in IS: 2959 and IS: 1822 unless otherwise specified.
- 2.2 The main contacts shall be of silver or silver alloy. The insulation class for the coils shall be class 'E'.
- 2.3 Contactors shall be provided with minimum 4 Nos. of auxiliary contacts. Out of which 2 Nos. will be normally closed and 2 Nos. normally opened.
- 2.4 A typical module wiring has to be approved by Engineer. The exact wiring to be made for each motor shall be intimated to the Contractor.
- 2.5 To provide facility for inclusion of interlocks, the control circuit has been developed with a number of breaks bridged up with jumpers. In actual wiring, these are to be provided on the terminal board bridging up with jumpers. This arrangement is considered essential to avoid jointing and tapping of wires for inclusion of interlocks.
- 2.6 The short time rating of the contactors shall be properly coordinated with the operating time of fuse preceding it.
- 2.7 The protective relays shall be flush mounted type and shall be in draw out type cases with built-in test facilities and having provision for CT shorting when the relays are drawn out. The relays shall be provided with externally reset operation indicators.
- 2.8 Wherever shown, auxiliary relays, contactors shall be furnished for interlocking and indication purposes.
- 2.9 All push buttons shall be heavy duty type suitable for flush mounting on sheet steel cubicle doors. The push buttons shall have one 'NO' and one 'NC' contact. The continuous current breaking capacity of the contacts shall be adequate for the duty involved. The contacts shall be rated for 10A at 240 V, 1 phase, 50 c/s. Push buttons shall be suitable colors according to their functioning.

10.0 SPECIFICATION FOR SWITCH BOARDS

10.1 STORING

The panels shall be stored under a shelter and in a well ventilated and dry place. Suitable polythene covers shall be provided for necessary protection against moisture.

10.2 ERECTION

Switchboards shall be installed on suitable foundation. Foundation shall be as per the dimensions supplied by the panel manufacturer. The foundation shall be flat and level. Suitable grouting holes shall be provided in the foundation. Suitable MS base channel shall be embedded in foundation on which the panel can be directly installed. The switch boards shall be properly aligned bolted to the foundation by at least four bolts. Cables shall be terminated on the bottom plate or top plate as the case may be, by using brass Siemens type double compression glands. The individual cables shall then be led through the panel to the required feeder compartments for necessary terminations. The cables shall be clamped to the supporting arrangement. The switchboard earth bus shall be connected to the local earth grid.

10.3 PRECOMMISSION TESTS

Panels shall be commissioned after the successful completion of the following tests. The tests shall be carried in the presence of Engineer.

- 3.1 All main and auxiliary bus bar connections shall be checked and tightened.
- 3.2 All wiring terminations and bus bar joints shall be checked and tightened.
- 3.3 Wiring shall be checked to ensure that it is according to the drawing.
- 3.4 All wiring shall be tested for insulation resistance by a 1000 Volts megger.
- 3.5 Phase rotation tests shall be conducted.
- 3.6 All relays and protective devices shall be tested for correctness of settings and operation.

10.4 **HARDWARE**

The erection rate shall include supply, fabrication, and installation of necessary M.S. channels for erection of switchboards.

11.0 **SPECIFICATION FOR MEDIUM VOLTAGE CABLES**

11.1 **SCOPE**

This specification covers the technical requirements of supply, laying, testing and commissioning of heavy duty medium voltage cables upto 1100 Volts for power, control and lighting application for efficient and trouble free operation.

The cable shall be properly packed for transportation, supply and delivery at site.

11.2 **CODES AND STANDARDS**

The materials covered by this specification shall unless otherwise stated as designed, constructed, manufactured and tested in accordance with latest revisions of the relevant Indian Standards.

IS 1554 (Part I) 1976	:	PVC insulated cables for working voltages upto and including 1100 V.
IS5831 1970	:	PVC insulation and sheath of electric cables.
IS8130 1984	:	Conductors for insulated electrical cables.
IS 3961 (Part II) 1977	:	Recommended current ratings for PVC insulated and PVC sheathed heavy duty cables.

11.3 **RATING**

The cable shall be rated for a voltage rating of 650/1100 Volts.

11.4 **SELECTION OF CABLES**

Cables have been selected considering the conditions of maximum connected load, ambient temperature, grouping factor, allowance voltage drops. However it is the responsibility of the contractor to recheck the sizes before cables are procured and connected.

11.5 **INSULATION**

The conductor is insulated with suitably compounded PVC applied to the conductor by the extrusion.

11.6 LAYING

Cables shall be laid as per the specification given below:

11.6.1 CABLES IN OUTDOOR TRENCHES

Cables shall be laid in outdoor trenches wherever called for. The depth of the trenches shall not be less than 75 cms from the formation ground level. The width of the trenches shall not be less than 45 cms. However, where more than 15 cms shall be allowed between the cables. The trenches shall be cut to square with vertical sidewalls and with uniform depth. Suitable shoring and propping may be done to avoid caving in of trench walls. The floor of the trench shall be rammed level. The cables shall be laid in trenches over the rollers placed inside the trench. The cable drum shall be rolled in the direction of the arrow for rolling. Wherever cables are bent, the minimum bending radius shall not be less than 12 times the diameter of the cable. After the cable is laid and straightened, it shall be covered with 8 cms thick layer of sand. Cable shall be then lifted and placed over this and cushion. The cable shall then be covered with a 8cms thick and cushion, where cable is laid in rocky situation.

Extra thick cushioning sand as may be required /decided by the Engineer shall be done without extra charge. Over this, a course of cable protection tiles or bricks shall be provided to cover the cables by 5 cms on either side. Unless otherwise specified the cable shall be protected by concrete tiles/stone slabs of minimum 25 mm thick placed on top of the trench breadth wise for the full length of the cable. Trench shall be back filled with earth and consolidated. Cables shall be laid in Hume pipes/stoneware pipes at all road crossings and in GI pipes at wall entries. Approved cable markers made of concrete blocks indicating the voltage grade and the direction of run of the cables shall be installed at regular intervals of 25 Mtrs. The depth of concrete blocks shall be at least 300 mm below ground and 50 mm above ground.

11.6.2 CABLES IN INDOOR TRENCHES

Cables shall be laid in indoor trenches wherever specified. Suitable painted M.S base plate, clamps, saddles, GI nuts/bolts shall be used for securing the cables in position at an interval not more than 450 mm. Spacing between the cables shall not be less than 15 cms centre to centre. Wherever specified, trenches shall be filled with fine sand and covered with steel chequered trench covers or RCC slabs.

All chases and passage if necessary for the laying of service cables at the entry or of premises shall have to be cut and made good to the satisfaction of the Engineer.

All cables entries into the buildings shall be laid on cable trays.

11.7 JOINTING AND END TERMINATIONS

Cable jointing shall be done as per the recommendations of the cable manufacturer. Jointing shall be done by qualified cable jointer under strict supervision.

Each termination shall be carried out using electroplated brass double compression glands and copper cable sockets and approved jointing materials are to be used. Hydraulic crimping tool shall be used for making the end terminations. Cable gland shall be bonded to the earth by using suitable size copper/G.I. wire. The cable armouring is to be earthed properly so that the earth continuity is maintained.

11.8 TESTING

11.8.1 Copy of cable test certificates of manufacturers shall be furnished to the Employer.

11.8.2 Cables shall be tested at site after installation and results shall be submitted to Engineer

11.8.3 Pressure test for 15 minutes.

11.8.4 Insulation resistance between conductors and neutral and conductors and earth.

12.0 SPECIFICATIONS FOR CABLES, CONDUITS AND WIRING

12.1 TYPE

Cables shall be with plain annealed copper conductor, PVC insulated, PVC sheathed and steel wire armored or steel tape armored construction. The conductors of cable shall be solid circular type.

12.2 RATING

The cable shall be rated for 1100 Volts.

12.3 CORE IDENTIFICATION

Cores shall be provided with the standard colour scheme of PVC insulation conforming to relevant standards.

12.4 CIRCUIT RATINGS

The current rating shall be based on the following conditions: -

- a) Maximum conductor temperature : 70° C.
- b) Ambient Air Temperature : 40/45° C.
- c) Ground Temperature : 30° C.
- d) Depth of Laying : 75 CM

12.5 STORING, LAYING, JOINTING AND TERMINATIONS

12.5.1 Storing

On receipt of cables at site, the cables shall be inspected and stored in a safe location.

12.5.2 Laying

Cables shall be laid as per the specifications given below: -

Cables in Outdoor Trenches: Cables shall be laid in outdoor trenches wherever called for. The depth of the trenches shall not be less than 75 cms from the final ground level. The width of the trenches shall not be less than 30 cms. However, where more than one cable is laid an axial distance of not less than 15 cms shall be allowed between the cables. The trenches shall be cut square with vertical sidewalls and with uniform depth. Suitable shoring and propping may be done to avoid caving in of trench walls. The floor of the trench shall be rammed well. Wherever cables are bent, the minimum bending radius shall not be less than 12 times the diameter of the cable. After the cable is laid and straightened, it shall be covered with 8cms thick layer of sand. The cable shall then be lifted and placed over this and cushion. The cable shall then be covered with 8 cms thick sand cushion. Over this, a course of cable protection tiles or burnt brick shall be provided to cover the cables by 5 cms on either side. Trenches shall be back filled with earth and consolidated and surplus earth to be disposed within the site as directed. Cables shall be laid in Hume pipes/stoneware pipes at all road crossings and in CI pipes at the wall entries. Approved cable markers made of CI indicating the voltage, number of cables and the direction of run of the cables shall be installed at regular intervals of 25 meters.

Cable Laid Indoors: Cable shall be laid in indoors wherever specified. Suitable clamps, hooks and saddles shall be used for securing the cables in position. Spacing between the cables shall not be less than 15 cms centre to centre.

12.5.6 JOINTING AND TERMINATIONS

Cable jointing shall be done as per the recommendation of the cable manufacturer. Jointing shall be done by qualified cable jointers. Each termination shall be carried out using brass compression glands and cables sockets. Hydraulic crimping tool shall be used for making the end terminations. Cable gland shall be bended to the earth by using suitable size G.I. wire/tape.

12.5.7 TESTING

Cables shall be tested at factory as per the requirement of IS 1554 Part-I. The tests shall incorporate routine tests, type tests and acceptance tests. Copy of such test certificates shall be furnished to the Employer's.

Cables shall be tested at site after installation and results shall be submitted to /Employer's.

13.0 SECTION - SPECIFICATION FOR RIGID STEEL CONDUITS AND ACCESSORIES:

13.1 GENERAL

Conduits shall be welded and screwed sheet steel construction. Conduits shall be black stove enameled outside. The wall thickness of conduits shall be as follows: -
19, 25 and 32 mm - 16 Gauge.

The sheet steel conduits shall conform to the requirements of IS: 1653 (Latest Edition) in all respects. The conduits shall have uniform wall thickness and uniform cross section throughout. The welding shall be uniform and good such that welded joints do not yield when subjected to a flattening test. The conduit shall be free from welding burrs. Welded joints do not yield when threaded or bent at an angle. Conduits shall bear the name or trademark of the manufacturer on each length. Conduits of less than 19 mm dia shall not be used. Conduit accessories such as bends, inspection bends, inspection tees, elbows, reducers, draw boxes, junction boxes, etc. shall be of approved make. The conduit accessories shall conform in all respects to IS: 3857. Boxes shall have internally tapped spouts. Junction boxes/inspection boxes shall be provided with suitable covers.

13.2 INSTALLATION OF CONDUITS

13.2.1 Open/Surface Conduit System:

Wherever, specifically called for, surface conduit system shall be adopted. Conduits shall be run in square and symmetrical lines. Before the conduits are installed, the exact route shall be marked at site and approval of the Engineer shall be obtained. Conduits shall be fixed by heavy gauge GI saddles secured to suitable rawl plugs, at an interval of not more than 1 Mtr. Wherever couplers, bends or similar fittings are used the saddles shall be provided on either side at a distance of 30 cms from the centre of such fittings. Conduits shall be jointed by means of screwed couplers and screwed accessories only. In long distance straight runs of conduit, inspection type couplers or running type couplers with jam nut shall be provided. Threading shall be long enough to accommodate pipes to the full threaded portion of the couplers and accessories. Cut end of conduits shall have neither sharp edges nor any burrs left to avoid damage to the insulation of the conductors.

Bends in conduit runs shall be done by bending conduits by pipe bending machine or any other suitable device as far as possible. Bends which cannot be negotiated by pipe bends shall be accompanied by introducing solid bends, inspection bends, or cast iron inspection box. The radius of solid bends shall not be less than 7.5 cms. Not more than three equivalent 90 degree bends shall be used in a conduit run from outlet to outlet. Conduit shall be properly drained and ventilated to prevent sweating or condensation inside the pipes. All the conduit openings shall be properly plugged with PVC stoppers/bushes.

Wherever conduits terminate into point control box, outlet box, distribution board, etc. conduits shall be rigidly connected to the box/board with check nuts on either side of the entry to ensure proper electrical and mechanical continuity.

13.2.2 Recessed Conduit System

Conduits which are to be taken in the ceiling slab shall be laid on the prepared shuttering work of the ceiling slab over the reinforcement bars before concrete is poured. The conduits shall be properly threaded and screwed into sockets, bends, junction boxes, outlet boxes and shall be made water-tight by using bituminous hemp yarn at the screwed ends. The conduits in ceiling shall be straight as far as possible to facilitate easy drawing of wires through them. Before conduits are laid in the ceiling, the positions of outlet points, junction boxes, etc. shall be set out clearly so as to minimize off-sets and bends.

Conduits recessed in walls shall be secured rigidly by means of steel hooks/ staples at 0.8 Mtrs intervals. Before conduit is concealed in the walls, all chases, grooves shall be neatly made to proper dimensions to accommodate the required number of conduits. To outlet boxes, point control boxes, inspection and draw boxes shall be fixed as and when conduit is being laid. The recessing of conduits in walls shall be so arranged as to allow at least 12 mm plaster cover on the same. All grooves, chases, etc. shall be refilled with cement mortar and finished upto the wall surface with cement mortar and finished upto the wall surface before plastering of walls is taken by the general contractor. Where conduits pass through expansion joints in the building, adequate expansion fittings or other approved devices shall be used to take care of any relative movement.

Running joints in conduits wherever necessary shall be rigidly held in aligned position by check nut tightened on running side. After conduits, junction boxes, outlet boxes, etc. are fixed in position, their outlets shall be properly plugged with PVC stoppers or with any other suitable material so that water, mortar, vermin or any other foreign materials do not enter into conduit system. All conduit ends terminating into an outlet, draw box, junction box, point control boxes, etc. shall be provided with PVC bushes, after the conduit ends are properly filled to remove burrs sharp edges. Concealed conduit laying, above false ceilings shall be executed in similar manner described above. Necessary GI pull wires shall be inserted into the conduit for drawing wires.

13.3 WIRING CONDUCTORS

13.3.1 GENERAL

All wiring conductors shall be PVC insulated, solid copper conductors of 1100 V grade. Wiring conductors shall conform in all respects IS: 694-1977 Part-II (Latest Amendment).

Wiring conductors shall be supplied in red, black, yellow, blue colors for easy identification of wires. The wiring conductors shall be supplied in sealed coils. The wiring conductors shall bear manufacturer's trademark, name, voltage, grade, etc.

13.3.2 INSTALLATION OF WIRING CONDUCTORS

The wiring conductors shall not be drawn into the conduits until all the works of any nature that may cause damage to the wires are completed. Proper care shall be taken in pulling the wires to see that no damage occurs to the insulation of the wires.

The installation and termination of wires shall be carried out with due regard to the following:-

While drawing the wiring conductors, care shall be taken to avoid scratches and kinks, which cause breakage of conductors. There shall be no sharp bends in the conduit system.

Insulation shall be shaved off like sharpening a pencil.

Strands of the wires shall not be cut for connecting to the terminals or lugs. The terminals shall have adequate cross section to take all the strands.

Ends of the wiring conductors shall be terminated by using crimping sockets. Soldering of sockets shall not be done. Ends of the conductors terminating into a switch/socket/connector shall be soldered.

Oxide inhibition grease shall be applied at all terminals and connections.

All the wiring shall be carried out in looping in system.

No joints are permissible in the wires except at end terminations.

The maximum number of various size conductors that could be drawn into various sizes of conduits shall be as per table II of IS: 732 (Latest Edition). The wiring shall be colour coded for easy identification.

The erection work has to be carried out under the supervision of Engineer.

G. TECHNICAL DATA

	FIRE HYDRANT AND SPRINKLER SYSTEM	:
I.	ELECTRICAL MOTOR DRIVEN BOOSTER PUMPS	
1.	Type	:
2.	Make	:
3.	Flow rate in LPM	:
4.	Delivery head in Mtrs	:
5.	Materials of impeller	:
6.	Rate speed in RPM	:
7.	Suction and delivery sizes in mm.	:
8.	Type of Drive recommended motor rating	:
9.	Recommended motor rating	:
10.	Material of casting shaft.	:
11.	Efficiency of the pump at rated capacity and head	:
II.	G.I.PPIPE	:
1.	Make	:
2.	Standard (IS/BS)	:
V.	LANDING VALVE	:
1.	Make	:
2.	Type	:
3.	Standard (IS/BS)	:

:

III BUTTERFLY VALVE

1. Make :
2. Material of seat :
3. Material of body :

IV HOSE PIPES :

1. Make :
2. Material of body :
3. Whether as per IS :

FIRE LIST OF RECOMMENDED MAKES**H. RECOMMENDED MAKES- SUPPRESSION SYSTEM****FIRE LIST OF RECOMMENDED MAKES****H. RECOMMENDED MAKES- SUPPRESSION SYSTEM****FIRE HYDRANT SYSTEM**

“In the list of recommended below, out of two-three makes mentioned in the list, only 1st make shall be quoted for and used. However if due to non-availability or any other technical reasons, the alternative make is allowed, it shall be subject to price adjustment as approved by the “Employer”

1	I. Galvanized pipes/MS pipes	Tata/Jindal
	II. GI/MS fittings	R brand/New brand/Koel / Tube bend / true forge
2	Ball Valves/Gate Valves	Leader / Audco / Hawk / Intervale / Zoloto / CRI / Key stone / Intervale / BDK / KSB/ Adbang
3	Foot valves & Non return valves / Check Valves	Leader / Audco / Hawk / Intervale / Zoloto / CRI / Key stone / Intervale / BDK / KSB/ Adbang
4	CI butterfly valves	Leader / Audco / Hawk / Intervale / Zoloto / CRI / Key stone / Intervale / BDK / KSB/ Adbang
5	Pumps	Kirloskar/Texmo/Mather & Platt/Voltas/Grundfos
6	Motors	Kirloskar/Siemens/Crompton Greives/ ABB
7	Pressure gauge	H-Guru/Bourdon/KI-International/Pricol / ABB
8	Pipe supports	Hi-Tech pipe support system
9	Hydrant valves, Branch pipe and allied accessories	Winco (UL approved)/Newage (UL approved)/H Sarakar/Shah bhogilal Audco/Intervale/BDK/Key stone/KSB/ Zoloto/Adbang/ safex
10	CP hose pipe	Jayashree (UL approved)/Newage (UL approved)/CRC/ Audco/Intervale/BDK/Key stone/KSB/ Zoloto/Adbang/ safex
11	Diesel engine	Kirloskar / Cummins
12	Battery	Exide/Approved equivalent/AMCO/ Amarraja/ HPL-NISE
13	Battery Charger	Chham Electricals/Servodyne
14	Pressure switch	Indfoss/Switzer/System sensor
15	Fire extinguishers	Alert/Safex/Excellent
16	Flow switch	Honeywell / system sensor / swidzer
17	Paint	Asian/Berger
18	Wrapping coating	Pypkote/Rusttech/IWL
19	Air release valve	Leader / Audco / Hawk / Intervale / Zoloto / CRI / Key stone / Intervale / BDK / KSB/ Adbang

20	Sprinkler bulbs	Spray safe (UL approved)/Viking / Tyco/Kidde
21	Sprinkler Alarm Valve	Spray safe (UL approved)/Viking / Tyco/Kidde
22	Welding Electrodes	Star/Advani/ESAB 28

RECOMMENDED MAKE OF ELECTRICAL MATERIALS

1	MCCB	ABB/ Siemens/ Schneider
2	Cable	CCI/ Universal
3	End Termination	Dowels/M Seal
4	Indicating meters	AE/Meco/IMP
5	Indicating lamps	Technique/Siemens
6	Power Contactors /Relays	ABB Schneider/Siemens
7	CT's	Kappa/Kalpa
8	ELCB/ELMCB	MDS/ Schneider/Siemens
9	Cable Tray	Storack/Indiana
10	Panel fabrication Colour - Red	Pragathi Controls – Bangalore/Load Controls/ Elins – Bangalore
11	Selector Switches	Siemens/Kaycee
12	Push Button Stations	Siemens/Kaycee
13	Motor Starters	Siemens/L&T
14	Terminal Block	Elmex/Toshiba

Note: All bought-out items shall be of makes approved by the Local Statutory Authority. Equivalent makes to be got approved by the Engineer prior to placement of order.

03. GAS SUPPRESSION SYSTEM

GAS BASED FIRE SUPPRESSION SYSTEMS

SCOPE OF WORKS: CODES & GENERAL REQUIREMENTS

SCOPE:

This specification covers the supply, installation, testing and commissioning of "Total Flood" Clean Agent fire Suppression System and various components, which constitute the system.

The equipments shall be properly packed for transportation, supply and delivery of the equipments at site.

CODES AND STANDARDS

The design, equipment, installation, testing and maintenance of the Clean Agent Suppression System shall be in accordance with the applicable requirements set forth in the latest edition of the following codes and standards:

- A. National Fire Protection Association (NFPA) 2001, Edition 2012
- B. Underwriters Laboratories, Inc. (UL)
- C. Factory Mutual (FM)
- D. Petroleum and Explosive Safety Organization (PESO)

The standards listed, as well as all other applicable codes, standards, and good engineering practices, shall be used as "minimum" design standards.

GENERAL REQUIREMENTS

The system shall be a Total Flood Clean Agent Fire Suppression System with UL listed & FM approved for the complete system.

The system shall be complete in all ways. It shall include a mechanical and electrical installation, all detection and control equipment, storage cylinders, discharge nozzles, pipe and fittings, manual release and abort stations, audible and visual alarm devices, auxiliary devices and controls, shutdowns, alarm interface, advisory signs, functional checkout and testing, training and any other operations necessary for a functional UL & FM approved Clean Agent suppression system.

The Vendor shall be responsible for the design, engineering, manufacture, assembly, installation, inspection, testing, spares, packing, supply, installation, testing and commissioning and successful handing over of complete clean agent system package works.

The Vendor shall ensure that the design complies with the requirements of this requisition, datasheets and other documents attached herewith, as well as various clarifications offered / changes effected in line with technical discussions / correspondence from time to time.

The minimum design concentration is based on the approved regulatory of the complete system such as UL, FM, NFPA 2001-2012 edition and authority having jurisdiction.

System shall be designed to protect single largest fire with selector/ directional valves to other protected risks for each building.

The system shall have 100% filled standby cylinders, (i.e. A reserve bank of Clean Agent filled cylinders with manifold, and automatic/manual change over to any of the two banks after actuation of main cylinders to be provided in each risk area i.e. 100% reserve).

The agent must be environmentally friendly and must be and in strict accordance with Kyoto Protocol, for which India is a signatory.

The agent must be derived from gases present in the earth's atmosphere, it exhibits no ozone depleting potential, does not contribute to global warming, nor does it contribute unique chemical species with extended atmospheric lifetimes.

The agent shall be a mixture of gases: 52% nitrogen, 40 % argon, and 8% carbon dioxide (IG541) OR 50% of Nitrogen and 50% Argon (IG55). The gas extinguishes fire by lowering the oxygen content below the level that supports combustion.

When agent is discharged into a room, it introduces the proper mixture of gases that still allow a person to breathe in a reduced oxygen atmosphere. It actually enhances the body's ability to assimilate oxygen.

The normal atmosphere in a room contains 21% oxygen and then than 1% carbon dioxide. The oxygen content is reduced below 15% most ordinary combustibles will cease to burn.

Composition and Materials

The basic system consists of extinguishing agent stored in high strength alloy steels cylinders. Various types of actuators, either manual or automatic, are available for release of the agent into the hazard area. The agent is distributed and discharged into the hazard area through a network of piping and nozzle. Each nozzle is drilled with a fixed orifice designed to deliver a uniform discharge to the protected area. On large hazards, where three or more cylinders are required a screwed or welded pipe manifold assembly is employed. The cylinder(s) is connected to the distribution piping or the manifold by means of a flexible discharge bend.

Cylinders - The cylinders are constructed tested and marked in accordance with applicable IS 7285 Standards. The complete system along with cylinder valve assembly shall be UL listed & cylinders shall be listed for to use with FM approved system.

Cylinder Assembly – The cylinder assembly is of steel construction with a red epoxy [corrosion resistant] finish. Each cylinder is equipped with a pressure seat-type valve equipped with gauge. The valve is constructed of forged brass and is attached to the cylinder providing a leak tight seal. The valve also includes a safety pressures relief device which provides relief as per CGA test method.

Cylinder charging pressure is either 150bar or 200bar at 21deg Celsius. The cylinders are shipped with a maintenance record card and shipping cap attached. The cap is attached to the threaded collar on the neck of each cylinder to protect the valve while in transit. The cylinder serial number and date of manufacture are stamped near the neck of each cylinder.

Electric Actuator – Electric actuation of an agent cylinder is accomplished by an agent cylinder is accomplished by an electric actuator interfaced through and Detection Control System. This actuator can be used in hazardous environments where the ambient temperature range is between 32 F and 130 F (0 C and 54 C). In auxiliary or override applications, a manual level actuator can be installed on top of the actuator.

Manual Actuators –Manual actuation is accomplished by pulling the hand lever on the actuator.

Nozzles – Nozzles are designed to direct the discharge of the agent using the stored pressure from the cylinders. The system design specifies the nozzle and orifice size to be used for proper flow rate and distribution pattern. The nozzle selection depends on the hazard and location to be protected.

Pressure Reducer – The pressure reducer is required in the distribution piping to restrict the flow of agent, thus reducing the agent pressure downstream of the reducer. The pressure reducer contains a stainless steel orifice plate which is drilled to the specific size hole required based on the hydraulic calculation. The orifice plate provides really visible orifice identification.

Pipe and Fittings – The System manifold must be constructed of Schedule 80 or 160 piping and class 2000 or 3000 bi.iron fittings, threaded or welded. The distribution piping down stream from the orifice union must be constructed of a minimum of Schedule 40 piping with class 300 malleable iron threaded fittings or welded steel fittings. All piping must be black iron of the following type and grade : ASTM A-53 seamless or electric resistance welded, grade A or B, or ASTM A-106 grade, A, B or C. **Do not use ASTM A-120, ASTM A-53 type F or ordinary cast iron pipe or fittings.**

The Nozzle & Piping sizes shall be confirmed based on the final flow calculations results determined from the UL listed/approved software.

The Fire Suppression System should be an engineered system utilizing a fixed nozzle agent distribution network. The system is designed and installed in accordance with the National Fire Protection Association (NFPA) Standard 2001, 2102 edition “Clean Agent Fire Extinguishing Systems”.

The system can be actuated by detection and control equipment for automatic system operation along with providing local and remote manual operation as needed. Accessories are used to provide alarms, ventilation control, door closures, or other auxiliary shutdown or functions.

A system installation and maintenance manual is available containing information on system components and procedures concerning design, operation, inspection, maintenance and recharge.

The system is installed and serviced by authorized distributors that are trained by the manufacturer.

The following are hazards that has to be protected by Total Flood Systems and annexure-1 shows the tentative bill of materials for the supply of 150bar IG541 system.

Sl no	Room Name	Length, m	Width, m	Height, m		
				CV	RV	FV
Block B						
1	Digital Photogrammetry	8.4	10.1	0.925	2.7	
2	Server room with false ceiling	8.4	5.5	0.925	2.7	
	Server room without false ceiling area-1	8.4	2.6	0	3.65	
	Server room without false ceiling area-2	8.4	2.4	0	3.65	
3	Bathymetry	5.6	3.5	0.925	2.7	
Block C						
4	Radio Chemistry lab	11.4	10.2	0.625	3	
5	Advanced Instrumentation	26	10.2	0.625	3	
6	Advanced Instrumentation	24.4	8.7	0.925	2.7	
7	Advanced Instrumentation	11.6	8.7	0.925	2.7	
8	Clean Room	2.1	3.5	0.625	3	
9	Clean Room	6.6	5	0.925	2.7	

The contractor shall provide the detailed bill of materials based on the approved design concentration for the complete system along with the necessary items that full fill the requirements of the complete system as per the NFPA 2001 standards even it is not specified in this specification.

SUBMITTALS

The installing contractor shall submit the following design information and drawings for approval prior to starting work on this project:

Field installation layout drawings detailing the location of all agent storage tanks, nozzles, pipe runs, including pipe sizes and lengths, control panels, detectors, manual pull stations, abort stations, audible and visual alarms, etc.

Separate layouts, or drawings, shall be provided for each level, (i.e.; room, sub floor, and above ceiling) and for mechanical and electrical work.

Electrical layout drawings shall show the location of all devices and include point-to-point conduit runs and a description of the method used for detector mounting.

Provide an internal control panel wiring diagram which shall include power supply requirements and field wiring termination points.

Separate drawing providing symbol legend and identifying all symbols used.

Annunciator wiring schematics and dimensioned display panel illustration shall be provided.

ALONG WITH TECHNICAL OFFER

List of clause wise deviations, if any, to the specifications in the deviation format. It will be bidder's responsibility to furnish the deviations. If the same are not furnished, it will be assumed that the offered system/ equipment meet the specifications of the enquiry document in totality. Deviation mentioned anywhere else, except for those mentioned in the deviation format, and shall not be considered.

Approval certificate of complete system including components and supplier's design software from the UL&FM

Approval certificate of CCoE / PESO for clean agent cylinders

Catalogues/Brochures giving technical particulars and details of operation/maintenance of the offered elements/system

Certificates of agencies that have accorded approval for the elements/components offered.

If the BIDDER is collaborating with any foreign party for basic engineering, design etc., he should provide certificate of collaboration.

Firm commitment and agreement with backup consultant for design, supply, engineering, construction, testing and commissioning etc. (furnish certificate).

Vendor to submit the tentative preliminary design calculation, Bill of Quantities, Preliminary Piping GA Drawing showing pipe size, Pipe routing, Discharge nozzle, Selector valves, Pressure Relief Vents, location of Control panel, manual release & abort station, hooter and hooter cum strobes, necessary integration details Fire detection system and other systems like AHU tripping, Warning sign location, in complete.

Numbers & placement/Area coverage for type of nozzles used

List of Mandatory and Recommended spares.

Relevant UL&FM listing document in support of minimum design concentration offered as per NFPA-2001 latest edition.

SL. No	Description	Vendor to Furnish
1	Type of System pressure [150/200bar]	
2	Formulation of Gas	
3	Nominal Charging Pressure	
4	Design Code	
5	System Approvals	
6	Design Concentration as per the approvals & latest NFPA 2001 edition	
7	Seamless Cylinder as per IS 7285	
8	Manufacturer	
9	Capacity	
10	Material	

11	Stored Pressure @ 21deg C	
12	Test Pressure	
13	Approval by [PESO/CCOE]	
14	Hydraulic Test Pressure as per NFPA	
15	Pressure Gauge Range	
16	Cylinder valve make	
17	Painting and colouring of pipeline, nozzles cylinder supports included	
18	Signal from the Clean Agent Control Panel for shuttering off the air handling unit and damper closing.	
19	Confirmation regarding the available space for cylinders (main+ standby) (Yes/No)	
20	Confirmation that Main, Standby and Mandatory Spares & Cylinders shall be supplied with gas	
	Inspection & Testing	
21	Visual inspection of installed system & hazard area	
22	Check of Labelling Device	
23	Check of mechanical tightness of piping & associated equipments	
24	Non-destructive operational tests for all devices included.	
25	Pneumatic Test for Downstream Pipings as per NFPA 2001	

AFTER AWARD OF CONTRACT

System design including computerized system flow calculations, piping and storage layout using approved listed software (UL & FM).

Hydraulic calculation for each risk area shall be provided. The complete output shall be submitted which also shows that there is no error in calculation and discharge time is less than as specified in NFPA using seamless steel cylinders.

List of Indian/International standards to which the offered equipments conform.

Catalogued /Brochures giving technical particulars and details of operation/maintenance of the offered elements/system.

Certificates of agencies that have accorded approval for the components/ elements offered.

Numbers and placement/area coverage for type of nozzles used. Quantity of each type of equipment offered along with the calculations.

Protected room area piping layouts along with the details-of supporting arrangement

Quantity of Clean Agent offered for various areas as per specifications.

P&ID and GA Drawing, Complete design calculation, drawing showing cylinder bank dimensional arrangement & housing details with dimensions, pipe size, pipe routing, supports, nozzle location, selector valves, pressure relief venting size, & location, manual release & abort station, hooter and hooter cum strobes, warning signs, I/O points from gas release panel in complete.

Calculations for pipe sizes, time of discharge, flow, nozzle rate of discharge etc.

GA and dimensional drawings of the areas showing storage, piping and nozzles for various areas

Mounting/fixing details of all the elements

Testing and inspection schedule and procedure

Test certificates of the gas/clean agent by international accrediting lab as agreed by the customer.

Cylinder data sheets (test cert, of clean agent by inter, accredited agency as agreed by the client)

If the BIDDER is collaborating with any foreign party for basic engineering, design etc., the design and detailed drawing shall be approved by the collaborator (certificate of collaboration shall be furnished during bidding).

Field installation layout drawings having a scale of A0 size, detailing the location of all Clean agent storage tanks, nozzles, pipe runs including pipe sizes and lengths, control panel(s), abort stations, audible and visual alarms, etc.

Separate layouts, or drawings, shall be provided for each level, (i.e.; room main void and under floor) and for mechanical and electrical work.

A separate layout or drawing shall show isometric details of agent storage Cylinders, mounting details, proposed pipe runs and sizes, and symbol legend.

Determine exact mass of agent required substantiated by pressure drop/flow calculation.

Complete hydraulic flow calculations computerized shall be provided for all engineered Clean Agent systems and should be vetted by consultant/OEM supplier.

Calculation sheet(s) must include the manufacturers name and UL listing number for verification. The individual sections of pipe and each fitting to be used, as shown on the isometrics, must be identified and included in the calculation. Total agent discharge time must be shown and detailed by zone.

Current consumption for the solenoid actuator, Horn and Horn cum Strobe

A complete sequence of operation shall be submitted detailing all alarm devices, shutdown functions, remote signaling, time delay and agent discharge for each zone or system.

Submit drawings, calculations and system component data sheets for approval to the local fire prevention agency, owner's insurance underwriter, and all other authorities having jurisdiction before starting installation.

Drawings/data sheets of System components like Cylinders, Nozzles, and Actuators etc.

Cause & Effect charts for integration of alarm & Clean Agent System

Manufacturer's Instructions: Submit manufacturer's instructions for system maintenance and recharge

Evaluation of nozzle flow rates & coverage by the nozzle for each room

Testing and inspection schedule and procedure according to NFPA 2001

List of drawings

Battery and charger sizing calculations

GA and schematic designs of Control Panel

Functional write up of control panel including battery charger.

Operating and maintenance manual

Program user's manual for software used for Clean Agent flow calculation.

ACCEPTANCE TEST

At the time "AS-Built" drawings and maintenance/operations manuals are submitted, the installing contractor shall submit a "Test Plan" describing procedures to be used to test the control system(s). The Test Plan shall include a step-by-step description of all tests to be performed and shall indicate the type and location of test apparatus to be employed. The tests shall demonstrate that the operational and installation requirements of this specification have been met. All tests shall be conducted in the presence of the AHJ and shall not be conducted until the Test Plan has been approved.

The tests shall demonstrate that the entire control system functions as designed and intended. All circuits shall be tested: automatic actuation and manual actuation, HVAC and power shutdowns, audible and visual alarm devices, and manual override of abort functions. Supervision of all panel circuits, including AC power and battery power supplies, shall be tested and qualified.

A room pressurization test shall be conducted in each protected space/largest risk to determine the presence of openings, which would affect the agent concentration levels. The test(s) shall be conducted using the Retro-Tec Corp. Door Fan system, or equivalent, with integrated computer program. All testing shall be in accordance with NFPA 2001.

SYSTEM INSPECTIONS

During the one-year warranty period, the installing contractor shall provide two (2) inspections of each system installed under this contract. The first inspection shall be at the six-month interval, and the second inspection at the 12-month interval. Inspections shall be conducted in accordance with the manufacturer's guidelines and the recommendations of NFPA 2001/ISO.

Documents certifying satisfactory system inspection shall be submitted to the AHJ upon completion of each inspection.

The complete system shall be tested (Dump test as per NFPA) to meet the approval of AHJ.

A thorough visual inspection of the installed system and hazard area. The piping, operational equipment and discharge nozzles shall be inspected for proper size and location. The locations of alarms and manual emergency releases shall be confirmed.

The hazard area shall be inspected closely for un-closable openings and sources of agent loss. The supplier shall furnish the composition certificate of Clean Agent satisfying the requirements of applicable clauses of NFPA-2001. Filling certificate should be provided specifying from which original Clean Agent drum the gas has been taken and which cylinder is filled.

A check of labeling of devices for proper designations and instructions. Name plate data on the storage cylinders shall adhere to specifications.

A test for mechanical tightness of the piping shall be conducted as per Clause 6- 7.2.2.12. of NFPA-2001

A flow test (puff test) using nitrogen shall be performed on the piping network to verify that flow is continuous and that the piping and nozzles are unobstructed as per Clause 6-7.2.2.13 and A-6-7.2.2.13 of NFPA-2001.

While testing and maintaining the system adequate Personal protective equipment shall be suitable for use and purpose.

INSTALLATIONS

Piping and fittings shall be as per NFPA 2001 guidelines, ASTM A-106 Sch.160/ 80 seamless carbon steel pipes and ASTM A-105 fittings, painted as per specification to "Fire Red" color and suspended from structural member in the ceiling through proper suspenders & clamps as per specification.

All system components and accessories must be installed by personnel trained by the manufacturer. All installations must be performed according to the guidelines stated in the manufacturer's design, installation, operation, inspection, recharge, and maintenance manual.

MAINTENANCE

Maintenance is a vital step in the performance of a fire suppression system. As such, it must be performed by an authorized contractor/distributor in accordance with NFPA 2001 and the manufacturer's design, installation, recharge, and maintenance manual.

TRAINING REQUIREMENTS

Prior to final acceptance, the installing contractor shall provide operational training to each shift of the owner's personnel. Each training session shall include control panel operation, manual and (optional) abort functions, trouble procedures, supervisory procedures, auxiliary functions and emergency procedures.

WARRANTY

Clean agent system components furnished and installed under this contract shall be warranted against defects in design, materials and workmanship for the full warranty period which is standard with the manufacturer, but in no case less than one (1) year from the date of system acceptance.

Agent for a period of up to twenty (20) years from the date of supply of the clean agent system


APPROVED MAKE

Kidde / Ansul / LPG / Chemetron / Kidde-Fenewal

04. LIST OF DRAWINGS

FIRE DETECTION AND PROTECTION SYSTEM DRAWINGS		
SL. NO	DRAWING NO.	DRAWING TITLE
01	F-101	GENERAL NOTES LEGENDS AND ABBREVIATIONS
02	F -102	FIRE FIGHTING LAYOUT - SITE PLAN
03	F-103	FIRE FIGHTING LAYOUT – GROUND FLOOR PLAN
04	F-104	FIRE FIGHTING LAYOUT - FIRST FLOOR PLAN
05	F-105	FIRE FIGHTING LAYOUT - SECOND FLOOR PLAN
06	F-106	FIRE FIGHTING LAYOUT - THIRD FLOOR PLAN
07	F-107	FIRE FIGHTING LAYOUT - TERRACE FLOOR PLAN
08	F-108	SCHEMATIC DIAGRAM FOR FIRE SUPPRESSION SYSTEM
09	F-109	SCHEMATIC DIAGRAM FOR FIRE DETECTION & PUBLIC ADDRESSABLE SYSTEM
10	F-110	STANDARD FIXING DETAILS – 01
11	F-111	STANDARD FIXING DETAILS – 02
12	F-112	PHE AND FIRE PUMP ROOM PLAN AND SECTION DETAILS

05. BILL OF QUANTITIES FOR FIRE DETECTION AND FIRE FIGHTING

<div>McD Berl <small>Building a Better Future</small></div> <div>McD Built Environment Research Laboratory Pvt Ltd</div>		
SUMMARY FOR FIRE PROTECTION WORKS FOR NCSCM, CHENNAI		
PART	DESCRIPTION OF WORK	AMOUNT
A	FIRE HYDRANT SYSTEM	
B	FIRE EXTINGUISHERS - FIRST AID	
C	PUMPS AND ACCESSORIES	
D	SPRINKLER SYSYTEM	
E	SIGNAGES	
F	FIRE DETECTION & ALARM SYSTEM	
G	TWO WAY TALK BACK SYSTEM	
	Grand Total	

BILL OF QUANTITIES FOR FIRE PROTECTION WORKS FOR PROPOSED NCSM, CHENNAI													
<p>NOTES:</p> <p>1. This cost is inclusive of sales tax (GST/IGST), VAT without C3 form, Works contract tax, Excise duty without C3 form, Shipment charges, customs clearing & forwarding, transportation charges, entry tax, education cess and other cesses, insurance, ESI, PF, Royalties, Octroi, loading & unloading charges, wastages, losses, damages and all other applicable taxes, duties, levies, sales tax/VAT/WCT and applicable services & indirect taxes etc.</p> <p>2. This cost is inclusive of all items in note 1 above except Excise duty, customs duty, service tax, sales tax/VAT/WCT and applicable service tax and indirect taxes.</p> <p>3. This cost is inclusive of all items in note 1 above including labour charges, and service tax, sales tax/VAT/WCT and applicable service tax and indirect taxes.</p> <p>4. This cost is inclusive of all items in note 1 above excluding Excise duty, customs duty, service tax and indirect taxes.</p> <p>5. These rates shall continue to be valid for one year from the date of collection from APPT & APFD and deposited back to the government and in no way to be applicable to APPT & APFD.</p> <p>6. All records of taxes collected from APPT & APFD and submitted to the government to be audited by APPT & APFD team or appointed consultants on monthly or quarterly basis and contractor needs to submit the clearance certificate for compliance along with each invoice.</p> <p>7. Whenever the quantities are zero it is Rate only item. Please quote the rate accordingly.</p>													
SL NO	DESCRIPTION OF WORK	TOTAL QUANTITY	UNIT	Supply	Installation ** see note 2	Total Rate Supply + see note 2	Basic Rate + see note 1	Sales Tax/VAT /WCT full consider	Excise Duty consider end	Customs Duty consider	Service Tax consider end	Total Rate Install + see note 1	Total Amount Supply and Installation + see note 1
SECTION A- FIRE HYDRANT SYSTEM													
1.0	Earth work excavation for trenches upto a maximum depth of 1.0 meters in all types of soil (depth of trench shall be as shown in the detailed drawing) including soft rock and disintegrated rock for laying fire water supply pipes. The soil shall be deposited on banks with all back fill, including necessary wooded/road free work where ever required. Depositing of the surplus earth after backfilling to a initial load of 30 meters. Refilling of the pipe line trenches and foundation with selected earth available from the trench excavation including watering consolidation in layers of 15cm thickness complete as per specifications. The back fill soil shall be graded and free from stones, pebbles, clay lumps and vegetation etc., complete as per the specifications, drawings and direction of the engineer.	170	Cum										
1.1	Same as above for hand rock including blasting.		Cum										
2.0 UNDERGROUND PIPING													
2.1	Supplying, installing, testing and commissioning of GI 1/2" class pipe line conforming to IS 1239 suitable special extruded type, such as Reducers, elbows, flanges, necessary paddle flanges for tank connection, laying of pipes in excavated trenches, proper supports at bottom. (Excavation, Foundation & refilling as per item Nos E-01 of Civil works) The pipes shall be anti corrosive wrapping treated. Wrapping material shall consist of three layers of high molecular high density polyethylene, three layers of polymeric bitumen and one layer of polyesters (total seven layers) Wrapping is applied over two coats of anti corrosive rubber modified bituminous primer of density 0.92 gm/cc and viscosity of 500 to 1000 cps applied at 150 gms per sq.ft (under ground piping)		Run										
2.2	100 mm dia		Run										
2.3	150mm dia		Run										
3.0 PIPING ABOVE GROUND													
3.1	Supplying, installing, testing and commissioning of GI pipes of class "C" to conform to IS 1239 suitable special extruded type, such as Reducers, elbows, flanges. The pipes shall be painted with primer & Paint using approved type. Galvanized, supports at standard spacing, anchor fasteners, bolts, nuts, clamps, rails "IP" & threaded bolt including cutting, Welding, fitting in / on walls, setting by using the support etc, as per drawings. The quoted rate shall also include for chipping / chipping walls, flanges, making bare holes in walls / floor and making them good with Non shrink filler material (as approved by Architect) in bare holes / finished in cement mortar etc complete. (Above Ground) The quoted rate shall include of Acrylic Fire stop Sealant (as per IS 12438:1988) in the opening for pipes, passing through fire compartment walls of RCC floors, masonry walls to provide up to 2 hours fire rating.		Run										
3.2	100mm dia		Run										
3.3	150mm dia		Run										
4.0	Supplying, installing, testing and commissioning of butterfly valves as per IS 5115 / IS 5116 dia used standard lever operated type with required flanges, bolts, nuts etc complete.		Nos										
4.1	100mm dia		Nos										
4.2	150mm dia		Nos										
4.3	200mm dia		Nos										
4.4	250mm dia		Nos										
4.5	300mm dia		Nos										
5.0	Constructing valve chamber made of brick masonry with bricks of class designation 75 in cement mortar 1:5 (1 cement:5 fine sand) 12 mm thick plaster on internal face with cement mortar 1:3 (1 cement:3 fine sand) including floating coat of neat cement and rough plaster on outer face complete with excavation in all kinds of soil back filling and cart away surplus earth as directed RCC top slab with GI masonry duty insulable cover and frame to be not less than 500kg)		Nos										
6.1	Class: 450 x 450 mm x 450mm (class designation)	3	Nos										
6.2	Supplying, installing, testing and commissioning of approved make 20mm dia automatic air release valve with suitable size of ball valves and unions etc. complete.	6	Nos										
7.0	Supply, installation, testing & commissioning of R.C.C NP2 class frame pipes laid to the required level and grade with collars joined with in CM:1.3. including encasing the pipe around a depth of not less than 15cm thick with selected earth (fine aggregate) available from the excavation as per specification and direction of the engineer. The excavated soil shall be deposited on banks with all back fill, including necessary wooded/road free work where ever required. Depositing of the surplus earth after backfilling to a initial load of 30 meters. Refilling of the pipe line trenches and foundation with selected earth available from the trench excavation including watering consolidation in layers of 15cm thickness complete as per specifications. The back fill soil shall be graded and free from stones, pebbles, clay lumps and vegetation etc., complete as per the specifications, and drawings.		Run										
7.1	250 mm dia		Run										
8.0	Supply, installation, testing and commissioning of Yacht hydrant comprising of the following: (i) 80mm dia pipe fitted with single headed Chose dia landing valve as per design; (ii) Providing Zoned 15m long 45mm dia CP hose with gun metal male and female instantaneous coupling; (iii) 45mm dia branch pipe with gun metal winged detachable nozzle made of instantaneous coupling (iv) Two keys in reverse type compartment for brass glass (v) 50 mm dia GI hand (vi) 80 mm dia GHT stand pipe (1 run above ground); (vii) Hose cabinet to accommodate two sets of controlled penetrating hose of 15m length with 1 pair of male and female coupling and 1 branch pipe with nozzle. The cabinet is made of MS sheet of 16 SWG thick, with a double door, glass front (4mm thick) with hinged door and lock. The cabinet is painted to match red colour like 3P/42/CP & wall mounted.		Nos										
	The pipe portion below ground shall be treated with anti-corrosive wrapping & coating of "Epoxy" make as per detailed specification. The quoted rate shall be inclusive of supply and fitting of hose cabinet with hinged front door and lock made of 16G MS sheet of suitable size to accommodate the above in MS cabinet with glass front and instantaneous valves.	9	Nos										
9.0	Supplying, installing and commissioning of fire brigade inlet connection conforming to IS 5290 comprising of 45mm dia instantaneous coupling complete, GI butterfly valve, connected to 150mm dia Fire hydrant ring main and fire hydrant use	1	Nos.										
10.0	Supplying, installing and commissioning of fire brigade inlet connection conforming to IS 5290 comprising of 200mm dia instantaneous couplings complete, GI butterfly valve, connected to 150mm dia fire hydrant	1	Nos.										
11.0	Supplying, erecting & commissioning Fire Hose cabinet comprising of internal hydrant: (i) 45mm dia instantaneous pattern single headed oblique hydrant valve with gun metal end GI elbow brass valve pipe end (ii) 2 lengths of 15mtrs, 45mm dia reinforced rubber lined hose with instantaneous male and female coupling (iii) 1 set gun metal branch pipe with nozzle (45mm x 20mm) with Gunmetal gate / ball valve (120mm) (iv) Two keys in reverse type compartment for brass glass (v) 15mm dia Reinforced hose reel 30m length as per IS 5117 fitted with 6.35mm dia nozzle and shut off valve (IS 508 - 1969). The hose reel shall be secured using type with reel drum. The hose shall be provided with coupling as per detailed specification.	24	Nos										
	(vi) The Frame shall comprise of 800 mm wide x 150 mm deep x 1200mm high made of 16 gauge 365 sheet to house the above accessories. The cabinet shall be firmly fixed to the wall with expansion bolts. The cabinet shall be powder coated both internally and externally. The door shall be provided with suitable locking arrangement as per standards. The quote shall include fitting the cabinet to the wall & making good to the wall.												
TOTAL FOR FIRE HYDRANT SYSTEM													
SECTION B- FIRE EXTINGUISHERS- FIRST AID													
12.0	Supplying, installing and commissioning of ABC Powder 6 Kg Fire Extinguisher containing Mono Ammonium Phosphate Powder 50, Stored Pressure Type, Pressure Gauge, fitted with discharge hose, wall mounting bracket etc. Discharge Time less than 15 Secs, Controllable discharge mechanism, Range minimum 4 Meters, applicable on Class A,B,C and electrically started Fire, A Rating: 8A, B Rating: 34B, Can Construction : Deep drawn & Galv. Mg welded, Valve Construction : Forging & Machining, Internal Coating of Can : Epoxy Powder coating, External Coating of Can: Epoxy Polyester Powder coating, Sheet metal thickness : 1.60MM, ISI approved as per IS 15601:2006.	43	Nos										
3.0	Supplying, installing and commissioning of ABC Powder 2 Kg Fire Extinguisher containing Mono Ammonium Phosphate Powder 50, Stored Pressure Type, Pressure Gauge, fitted with discharge hose, wall mounting bracket etc. Discharge Time less than 15 Secs, Controllable discharge mechanism, Range minimum 4 Meters, applicable on Class A,B,C and electrically started Fire, A Rating: 8A, B Rating: 34B, Can Construction : Deep drawn & Galv. Mg welded, Valve Construction : Forging & Machining, Internal Coating of Can : Epoxy Powder coating, External Coating of Can: Epoxy Polyester Powder coating, Sheet metal thickness : 1.60MM, ISI approved as per IS 15601:2006.	6	Nos										
4.0	Mechanical foam unit of 9 lit. Capacity with water inlet and foam water out let, foam maker, foam branch pipe etc. complete. Unit shall be fabricated by MS, sheet with FRP lining inside and whole unit mounted with rubber wheels of suitable size and handle for easy use.	2	Nos										
5.0	Fire buckets (FILLED WITH SAND) round bottom type enamel painted, white inside & Red out side and Letter "FIRE" in black out side and handle with mounting bracket.	16	Nos										
TOTAL FOR FIRE EXTINGUISHERS- FIRST AID													
SECTION C- PUMPS AND ACCESSORIES													
1.0	Supply, fitting, testing and commissioning of Electric Motor Driven Booster Pump complete with Pump Set, Electric Motor, Base Frame and all accessories like pressure switch, pressure gauges, Butterfly valves, NRV etc as per NBC, PCC foundation and foundation bolts as per specifications, the quoted rate inclusive of Starter, Panel and Cable from Panel to Pump and duty conditions as follows (working and 1 Stand By): (i) Flow rate: 450 ltrs/Min (ii) Head: 40 Meter (iii) Drive: Single Phase	5	Nos										
2.0	Supply, fitting, testing and commissioning of Electric Motor Driven Fire pump complete with pump set, electric motor, Base Frame and all accessories like PCC foundation and foundation bolts as per specifications and duty conditions as follows: (i) Flow rate: 2200 ltrs/Min (ii) Head: 40 Meter (iii) Drive: Single Phase	1	Set										
3.0	Supply, fitting, testing and commissioning of Electric Motor Driven Fire pump complete with pump set, electric motor, Base Frame and all accessories like PCC foundation and foundation bolts as per specifications and duty conditions as follows: (i) Flow rate: 2200 ltrs/Min (ii) Head: 40 Meter (iii) Drive: Single Phase	1	Set										

CONSULTANTS: MCDERMID

CONSULTANTS: MCDERMID

06. BILL OF QUANTITIES FOR FIRE GAS SUPPRESSION



McD Built Environment Research Laboratory Pvt Ltd

SUMMARY FOR FIRE SUPPRESSION WORKS FOR NCSCM, CHENNAI

PART H	
DESCRIPTION OF WORK	AMOUNT
Total for GAS SUPPRESSION	
Convert in INR using 63	
Freight & customs Duty	
SITC of Piping & Fittings	
N2 testing for Piping	
Room Integrity INR 1,75,000 per room	
Grand Total	

BILL OF QUANTITIES FOR FIRE SUPPRESSION WORKS FOR PROPOSED NCSCM, CHENNAI

Rev, R0

SL NO	DESCRIPTION OF WORK	TOTAL QUANTITY	UNIT	AMOUNT
	SECTION - H - GAS SUPPRESSION SYSTEM			
	Supply, Installation, Commissioning & Testing along with Piping, fittings & other accessories to complete the system in all respects as per the specification.			
	Vendor to quote all the necessary items even if it is not mentioned below.			
	Block B - Main & Reserve			
1	Supply of Cylinder,, Corrosion resistant paint [Red Epoxy] ., 435 cu.ft. w/CV98 Valve	26		
2	Flexible Discharge Bend	26		
3	Actuator, Electric, HF	7		
4	Booster Actuator	7		
5	Booster Actuator, Reset Tool	1		
6	Actuator Arming Tool for HF Elec. Actuator and Pneu. Actuator	1		
7	Actuator, Lever for HF Actuator	7		
8	Orifice Flanged, 2 1/2 in., Weld Neck	2		
9	Orifice Union, 1 1/4 in. NPT	1		
9	Switch, Pressure, DPST, Weather Proof (2 - 3/4 in. Outlets)	3		
10	Nameplate - MAIN	1		
11	Nameplate - RESERVE	1		
11	Warning Plate - Inside Room with Alarm	3		
12	Warning Plate - Outside Room without Alarm	3		
13	Nozzle, INERGEN, 1 1/2 in. NPT, 360 deg.	10		
14	Nozzle Deflector Shield, INERGEN, 1 1/2 in.	10		
14	Nozzle, INERGEN, 1 in. NPT, 360 deg.	8		
15	Valve, Selector, 2 inch	1		
16	Valve, Selector, 2, 2 1/2, 3 in. (for use w/manual or electric actuation)	2		
17	Valve, 2 1/2 in. Check (Threaded)	4		
18	Vent Plug	8		
19	1/2 Manifold relief valve	8		
14	Pilot Valve Actuation Adapter	6		

15	Male Elbow (use with Pilot Valve Actuation Adapter, P/N 73236)	4		
16	Male Branch Tee	2		
17	Actuation Hose, Swivel, Stainless Braided, 16 in.	4		
	Block C - Main & Reserve			
1	Cylinder, Corrosion resistant paint [Red Epoxy], 435 cu.ft. w/CV98 Valve	78		
2	Flexible Discharge Bend	78		
3	Actuator, Electric, HF	18		
4	Booster Actuator	18		
5	Booster Actuator, Reset Tool	1		
6	Actuator Arming Tool for HF Elec. Actuator and Pneu. Actuator	1		
7	Actuator, Lever for HF Actuator	18		
8	Orifice Flanged, 4 in., Weld Neck	2		
9	Orifice Flanged, 3 in., Weld Neck	2		
10	Orifice Flanged, 3 in., Weld Neck	2		
9	Switch, Pressure, DPST, Weather Proof (2 - 3/4 in. Outlets)	6		
10	Nameplate - MAIN	1		
11	Nameplate - RESERVE	1		
11	Warning Plate - Inside Room with Alarm	6		
12	Warning Plate - Outside Room without Alarm	6		
13	Nozzle, INERGEN, 1 1/2 in. NPT, 360 deg.	27		
14	Nozzle Deflector Shield, INERGEN, 1 1/2 in.	27		
14	Nozzle, INERGEN, 1 in. NPT, 360 deg.	26		
15	Valve, Selector, 2 inch	2		
16	Valve, Selector, 2, 2 1/2, 3 in. (for use w/manual or electric actuation)	2		
17	Valve, Selector, 4 in. (for use w/manual or electric actuation)	2		
17	Valve, 2 1/2 in. Check (Threaded)	12		
18	Vent Plug	12		
19	1/2 Manifold relief valve	13		
14	Pilot Valve Actuation Adapter	28		
15	Male Elbow (use with Pilot Valve Actuation Adapter, P/N 73236)	12		
16	Male Branch Tee	20		
17	Actuation Hose, Swivel, Stainless Braided, 16 in.	24		
	TOTAL			